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# Report of the Arctic Fisheries Scientific Advisory Committee for 1988/89

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Department of Fisheries and Oceans
Winnipeg, Manitoba R3T 2N6

May 1990

# Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2063

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Fisheries and Aquatic Sciences 2063

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# REPORT OF THE ARCTIC FISHERIES SCIENTIFIC ADVISORY COMMITTEE FOR 1988/89

by

S.E. Cosens, J.F. Craig and T.A. Shortt

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## ABSTRACT

Cosens, S.E., J.F. Craig, and T.A. Shortt. 1990. Report of the Arctic Fisheries Scientific Advisory Committee for 1988/89. Can. Manuscr. Rep. Fish. Aquat. Sci. 2063: iv + 40 p.

The Arctic Fisheries Scientific Advisory Committee (AFSAC) was established in November 1985 to develop and provide scientifically sound advice for stocks of fish and marine mammals in the Northwest Territories, Yukon north slope and other territorial waters managed by the Central and Arctic Region of the Department of Fisheries and Oceans. AFSAC is comprised of a Chairperson, Executive Committee, Fish Subcommittee and Marine Mammals Subcommittee; operates on the peer review principle; reports to the Director, Biological Sciences and advises the Regional Director General and Regional Director, Fisheries and Habitat Management. In 1988/89, AFSAC reviewed and developed advice on five fish stocks/stock complexes, annual commercial quotas for Arctic charr in the NWT and five marine mammal stocks. AFSAC concludes that, in general, the management of these stocks of fish and marine mammals is scientifically sound given the current limits of knowledge and understanding.


Key words: Arctic zone; fish; management; marine mammals; research; stocks.


## RÉSUMÉ

Cosens, S.E., J.F. Craig, and T.A. Shortt. 1990. Report of the Arctic Fisheries Scientific Advisory Committee for 1988/89. Can. Manuscr. Rep. Fish. Aquat. Sci. 2063: iv + 40 p.

Le Comité scientifique consultatif des pêches canadiennes dans l'Arctique (CSCPCA) a été créé en novembre 1985 dans le but d'étudier de manière rigoureusement scientifique les stocks de poissons et de mammifères marins des Territoires du Nord-Ouest, du versant nord du Yukon et des eaux territoriales gérées par la Région du Centre et de l'Arctique. Le CSCPCA est composé d'un président, d'un comité exécutif, d'un sous-comité des poissons et d'un sous-comité des mammifères marins; il fonctionne selon le principe de révision par les pairs, rend compte de ses activités au Directeur des Sciences biologiques et conseille le Directeur général régional, le Directeur régional du service de Gestion des pêches et de l'habitat. En 1988-1989, le CSCPCA a examiné cinq complexes stocks de poissons et cinq stocks de mammifères marins ainsi que sur les quotas commerciaux annuels de l'omble de l'Arctique, et fait des recommendations à leur égard. Le CSCPCA conclut que de manière générale et compte tenu de l'état actuel des connaissances, ces stocks de poissons et de mammifères marins sont gérés de manière rigoureusement scientifique.


Mots-clés: zone de l'Arctique; poisson; gestion; mammifères marins; programmes de recherche; stocks.

# OVERVIEW OF THE ARCTIC FISHERIES SCIENTIFIC ADVISORY COMMITTEE: 1988/89

## INTRODUCTION

The Central and Arctic Region of the Department of Fisheries and Oceans (DFO) manages and protects the fishery resources of the Northwest Territories (NWT), the north slope of the Yukon, the tidal waters of Manitoba and Ontario, and with two exceptions, the offshore territorial waters. Fishery management in coastal marine waters bordering northern Quebec in James Bay, Hudson Bay and Hudson Strait has been assigned to the Quebec Region of DFO. Fisheries in offshore waters of Davis Strait and the eastern portion of Hudson Strait (NAFO areas 0B and 2G north of 60°N) are managed in conjunction with the Northwest Atlantic Fisheries Organization (NAFO) and the Newfoundland Region of DFO.

The Northwest Territories and the north slope of the Yukon contain about 36% of Canada's land and 18% of its fresh waters. The Arctic coastline comprises 71% (172 979 km) of Canada's coastline. The total marine area is about 3.2 million $km^2$ or about 67% of Canada's coastal waters. The land is sparsely populated by some 50 000 people with equal proportions of Indian and Metis, Inuit, and people of other ethnic origins.

The harvesting of fish and marine mammals has always been a dominant human activity in the Canadian Arctic. Fish and marine mammal resources serve several functions in the social, cultural and economic life of northerners, particularly Indians, Metis and Inuit. Domestic (=subsistence) and recreational (=sport) harvesting occurs in all areas where people live or travel. Commercial fisheries occur in waters of Davis Strait and Baffin Bay, some coastal rivers and a few lakes such as Great Slave Lake.

Northern residents increasingly are looking towards fishery resources to provide food, cultural experiences and recreation for a growing population. They also wish to diversify their economic base through the development of new commercial fisheries and the sale of fish products between northern communities and to the south. Management of the Arctic fishery must take account of the social as well as economic value of the resource.

Beluga (Delphinapterus leucas), narwhal (Monodon monoceros), bowhead whale (Balaena mysticetus), walrus (Odobenus rosmarus) and several seal species occur in the eastern Arctic and Hudson Bay and, with the exception of walrus, also occur in the western Arctic. Commercial whaling, which began about 1600 and continued until 1969, has had a major effect. Bowhead was the main quarry, although there was some harvesting of beluga, narwhal, walrus and seals. Currently in Canada, all stocks of these species are harvested in domestic hunts, except for the bowhead whale which is recognized as being an endangered species. Statistics on the numbers of beluga and narwhal taken in domestic hunts during 1987 and 1988 are provided in Table 1. Several of the stocks are also harvested off northern Quebec and in Alaskan and Greenland waters. As a result of historical commercial whaling, bowhead and stocks of beluga known as eastern Hudson Bay, Ungava Bay and southeast Baffin are reduced in numbers. The walrus is reduced in range and probably numbers, and the harbour seal is reduced in range and numbers. In contrast, no evidence exists that hunting has affected the numbers or range of other beluga stocks, narwhal stocks or other species of seals, nor is there evidence that these stocks and species are being harvested at levels which cannot be sustained. However, only the ringed seal appears to have potential for supporting an increased harvest.

Important freshwater and anadromous fish resources occur throughout the Canadian Arctic. Anadromous Arctic charr (Salvelinus alpinus) is important along the Arctic coasts, and anadromous whitefishes and ciscoes (Coregonus spp.) occur in the lower Mackenzie River and along the Beaufort Sea coast. Whitefish, ciscoes and lake trout (Salvelinus namaycush) occur throughout the inland area and are especially important in the Mackenzie Valley and Mackenzie Delta. Northern pike (Esox lucius) and walleye (Stizostedion vitreum) are important in some inland areas, as are Arctic grayling (Thymallus arcticus), inconnu (Stenodus leucichthys) and burbot (Lota lota). These species support various domestic, commercial and recreational fisheries. Recreational fishing remains as an important aspect of the overall fishery in NWT with sport fishing licence sales reaching a high of 17 304 in 1987-88 followed by 16 716 in 1988-89 (see Table 2). The main species taken were lake trout, walleye, northern pike, Arctic grayling and Arctic charr. The whitefishes of the Mackenzie Delta are, perhaps, the only major underexploited Arctic freshwater fish resource, but some Arctic charr stocks and other small, remote fish stocks may be under-exploited as well.

Marine fish and shellfish are of less direct importance in the NWT at present, although several species are harvested commercially in the Davis Strait-Hudson Strait area, primarily by southern Canadian and foreign fishermen. In 1985, NAFO established total allowable catches (TAC) of 28 300 tonnes for Atlantic cod (Gadus morhua) and 9 000 tonnes for redfish (Sebastes spp.) in the Greenland part of these waters, and 25 000 tonnes for Greenland halibut (Reinhardtius hippoglossoides), 8 000 tonnes for roundnose grenadier (Coryphaenoides rupestris) and 36 000 tonnes for shrimp (Pandalus montagui and P. borealis) in the Canadian plus Greenland waters. In 1988 DFO licenced a commercial fishery for Greenland halibut in Cumberland Sound with a quota of 100 tonnes. Residents of the NWT currently are expressing more interest in commercial harvesting of these resources especially cod, Greenland halibut, shrimp and Iceland scallops (Chlamys islandicus) in the Davis Strait-Hudson Strait area, capelin in Hudson Bay and Pacific herring (Clupea harengus) in the Beaufort Sea. These and other marine fish, such as flounders and other species of cod, invertebrates, such as clams, mussels and starfish, and marine plants, such as kelp, are also harvested for local consumption.

## THE ROLE OF THE ARCTIC FISHERIES SCIENTIFIC ADVISORY COMMITTEE

One part of the process for the management of these important fish and marine mammal resources is ensuring that scientifically sound advice is provided to those responsible for making fishery management decisions. Consequently, the Arctic Fisheries Scientific Advisory Committee (AFSAC) was established in November, 1985, to develop and provide this advice.

AFSAC was implemented, under the direction of the Director of Biological Sciences, as an internal DFO committee to enable the Central and Arctic Region to provide biologically sound advice to fishery management boards, to demonstrate the biological soundness of the Region's fishery management decisions to other resource users, industry and government agencies, to assess the biological basis for these decisions and to ensure that all advice is subject to peer review of its scientific quality. The availability of biologically sound advice would result in increased DFO effectiveness in consultations with clients. AFSAC's objective is:

> to provide sound biological advice to Fisheries Management (the Director General and Regional Director of Fisheries and Habitat Management of the Central and Arctic Region) on Arctic fish and marine mammal stocks so that management decisions result in the long-term well-being of these stocks.

Its specific responsibilities as stated in the Terms of Reference and Operating Procedures, April, 1987, are:

a) to assess the status of fish and marine mammal stocks and to make biologically sound recommendations on harvest levels;
b) to assess other biological aspects of management (such as size restrictions, closed seasons, mesh size, etc.) and to make biologically sound recommendations on such operational requirements for management;
c) to assess the adequacy of biological information available for making fisheries management decisions and to make recommendations for its extension or improvement;
d) to review and assess biological aspects of general management plans for fish and marine mammals; and
e) to respond to any other requests for biological advice on fisheries management and habitat issues from the Director General, Regional Director of Fisheries and Habitat Management, Regional Director of Science, or Director of Biological Sciences, Central and Arctic Region, as may from time to time arise.

In summary, AFSAC is charged with ensuring that all available data, whether they are from harvest monitoring, stock assessment, research or experimental management, are used and interpreted to provide the best possible scientific advice to the Region's fishery managers.

In 1988, as a result of directions from senior management within DFO, new terms of reference were prepared to provide an expanded scope for AFSAC. These draft Terms of Reference are in the final stages of review prior to complete implementation. Some provisions of the new Terms of Reference, namely the establishment of an AFSAC coordinator based in Winnipeg have already been put into effect.

Because of the geographical overlap of responsibilities within DFO and the migratory nature of several fish and marine mammal species, other jurisdictions (e.g. Quebec Region, Greenland/Denmark, Alaska/USA) and other review processes (e.g. Canadian Atlantic Fisheries Scientific Advisory Committee) are involved in the development of scientific advice on the management of selected stocks.

## AFSAC MEMBERSHIP

AFSAC discharges its responsibilities through the activities of its Chairperson, Executive Committee, Fish Subcommittee and Marine Mammals Subcommittee. The majority of members are from the Central and Arctic Region, DFO, while the Quebec Region, DFO, was represented on all committees in 1988/89. The membership of AFSAC during 1988/89 was:

Chairperson and
Executive Committee:

| | |
|---|---|
| R. Clarke | (Pacific and Freshwater Fisheries (P&FF), Central and Arctic Region) AFSAC Chairperson 01/04/88-14/07/88 |
| G. Koshinsky | (Science, Central and Arctic Region) AFSAC Chairperson, 15/07/88-14/12/88 |
| T. Shortt | (Science, Central and Arctic Region) AFSAC Coordinator beginning 01/07/88, acting Chairperson 15/12/88-31/03/89 |
| A. Mansfield | (Science, Quebec Region) |
| R. Moshenko | (P&FF, Central and Arctic Region) Marine Mammals Subcommittee Chairperson 01/04/88-14/07/88 |
| S. Cosens | (Science, Central and Arctic Region) Marine Mammals Subcommittee Chairperson 15/07/88-31/03/89 |
| J. Craig | (Science, Central and Arctic Region) Fish Subcommittee Chairperson |

Fish Subcommittee:

| | |
|---|---|
| J. Craig | (Science, Central and Arctic Region) Chairperson |
| L. Johnson | (Science, Central and Arctic Region) |
| C. Hudon | (Science, Quebec Region) |

| | |
|---|---|
| A. Kristofferson | (P&FF, Central and Arctic Region) |
| J. Reist | (Science, Central and Arctic Region) |
| A. Bodaly | (Science, Central and Arctic Region) |

Marine Mammals Subcommittee:

| | |
|---|---|
| S. Cosens | (Science, Central and Arctic Region) Chairperson 15/07/88-31/03/89 |
| R. Moshenko | (P&FF, Central and Arctic Region) Chairperson 01/04/88-14/07/88 |
| M. Kingsley | (Science, Central and Arctic Region/ Science, Quebec Region as of of 09/88) |
| P. Richard | (P&FF, Central and Arctic Region) |
| T. Smith | (Science, Quebec Region) |
| R. Stewart | (Science, Central and Arctic Region) |
| T. Strong | (P&FF, Central and Arctic Region) |

## AFSAC ACTIVITIES

During 1988/89 a number of changes occurred in the membership of AFSAC, with the Chair being occupied by three different people, in part due to Departmental reorganization activities and other work assignments for members of the Executive Committee. In July, 1988, the position of AFSAC coordinator was staffed, thereby providing a person whose responsibilities included the day to day operation of the affairs of AFSAC. The AFSAC annual report for the first two years of AFSAC activities was completed and submitted for publication as Canadian Manuscript Report of Fisheries and Aquatic Sciences No. 2015.

To aid its work, AFSAC commissions the preparation of background reports on specific topics; these are internal working documents solely for the use of AFSAC members. A schedule for review of important fish and marine mammal stocks was established in consultation with the Director, Fisheries and Habitat Management and the Director, Biological Sciences. The proposed schedule for AFSAC reviews in 1989/90 and 1990/91 which includes, the name(s) of the authors commissioned to prepare the background reports is provided as Table 3.

During 1988/89, AFSAC reviewed background reports on five fish stocks and four marine mammal stocks, as well as reports on fish in specific areas and commercial anadromous Arctic charr fisheries (see Appendix 1). The AFSAC background reports on fish stocks were reviewed at the Winnipeg meeting of the Fish Subcommittee on 7-8 February 1989. The Marine Mammals Subcommittee met in Winnipeg on 2-3 February 1989 to review the marine mammal background reports. At those meetings, the Subcommittees concluded their reviews of the documents and developed their recommendations. An urgent second review of the Southeast Baffin beluga stock which had been reviewed in 1986/87 by AFSAC, was requested by the Regional Director, Fisheries and Habitat Management in July, 1988. The previously prepared stock status sheet for that stock of beluga was revised to reflect more current information on stock size and harvest data. The final version was included in the 1988/89 report of the Marine Mammals Subcommittee and is contained in this annual report.

## GENERAL RESULTS

The main results of AFSAC's activities in 1988/89 continued to be the development of management recommendations and the identification of research requirements for five fish stocks/stock complexes, commercial quotas for anadromous Arctic charr, and five marine mammal stocks. AFSAC recommendations that no hunt be allowed for two of the marine mammal stocks were significant in that the stocks were considered endangered and management action as a result has reflected these recommendations.

To aid the presentation of the background information and recommendations for each stock, a common reporting format was developed which was used for most reviews. The basic format is:

- Introduction
- Background
  - Stock definition
  - Stock size
  - Vital parameters
  - Current harvest
  - Other impacts
- Major issues
- Assessment
  - Stock prognosis
- Management recommendations
- Research requirements
- Next AFSAC review

The specific recommendations from each review are contained in the reports of the Fish Subcommittee for 1988/89, and of the Marine Mammals Subcommittee for 1988/89; these constitute the two major sections of this report. They include summaries of the information presented and AFSAC's advice on the stocks considered.

## GENERAL CONCLUSIONS

During 1988/89 the Department of Fisheries and Oceans continued negotiations with the Government of the Northwest Territories (GNWT) with the aim of delegating responsibilities for the day to day management of freshwater fisheries from DFO to GNWT. With these negotiations ongoing during that period and a final agreement unlikely until 1990, the future role of the Department of Fisheries and Oceans remained not clearly defined; neither was that of freshwater scientific research in the NWT nor the role of AFSAC in providing advice on those fisheries. As a result of this uncertainty, the Fish Subcommittee of AFSAC was reluctant to make strong suggestions for subsequent reviews for those freshwater stocks reviewed during 1988/89.

Marine fish species and stocks have emerged as priorities, as reflected in their inclu-

sion in the reviews by the Fish Subcommittee in 1988/89. Reviews of Greenland halibut as well as Iceland scallops in the eastern Arctic were timely, as commercial fisheries for both stocks have since commenced or are continuing and expanding. However, biological data on these and other Arctic species are still inadequate. The Fish Subcommittee echoes the conclusions of the Subcommittee in 1987/88, which outlined the importance of an improved data base for the management of Arctic fisheries. There is a continuing need to acquire basic biological data on new species, particularly those in the marine environment not previously exploited for commercial or subsistence purposes. As well, there is a need for continuity in the collection of data, a need for collection of accurate and uniform catch statistics, as well as for continued research on genetic stock identification and on recruitment.

Several Arctic marine mammal species command a high priority due to hunting pressures and diminishing population sizes. Among those species, beluga, narwhal and bowhead whales were subjects of reviews by the AFSAC Marine Mammals Subcommittee in 1989.

That Subcommittee concluded that quotas for Arctic marine mammal stocks should be established on the basis of total allowable harvest (TAH) rather than the more commonly used total allowable catch (TAC). TAH includes landed animals plus those which have been struck and killed or injured but lost. A quota based on a TAH encourges more efficient hunting practices to minimize the number of lost whales, while maximizing landings.

Similar to the conclusions of the Fish Subcommittee, the Marine Mammals Subcommittee pointed out the need for continued studies to provide proper identification of stocks as well as the need for stock specific vital parameters for most, if not all marine mammal stocks in the Arctic.

Particular problem areas for stock identification were noted for beluga in Hudson Bay and Hudson Strait, where it is believed that up to four discreet stocks may overlap during migratory and overwintering periods.

Due to lack of specific vital parameters for some Arctic marine mammal stocks, mortality and recruitment rates based on those derived from studies of other non-Arctic odontocetes have been used to calculate total allowable harvests (TAH) for Arctic beluga and narwhal stocks. This procedure is considered to be inadequate, as vital rates differ between species, however, extremely limited opportunities exist to sample Arctic stocks, making the development of vital rates difficult, and in the case of bowhead whales, almost impossible. The Marine Mammal Subcommittee concluded that other types of "collectable" data must be investigated as a means of assessing population trends and allowing more accurate management recommendations.

## REPORT OF THE AFSAC MARINE MAMMAL SUBCOMMITTEE: 1988/89

The Marine Mammal Subcommittee met on 2-3 February 1989 to discuss background reports received on the narwhal stock in the high Arctic and the western Hudson Bay stock of belugas, a request for advice on managing beluga stocks and two requests for reviews of bowhead whales. The Subcommittee also re-evaluated the Southeast Baffin beluga AFSAC stock sheet which had first been prepared in 1986/87. The Subcommittee did not update previous reports for the ringed seal because there was no new information available. Background reports on bearded, harbour and harp seals, Lancaster Sound beluga, Bering Sea or western Arctic bowhead and eastern Arctic bowhead were not available for review at the meeting. These stocks were rescheduled for review by AFSAC in 1989/90 (Table 3). The background document on eastern Arctic bowhead became available after the meeting, was subsequently reviewed by the Subcommittee, and the stock sheet is included in this report.

The following background reports were reviewed by the Marine Mammals Subcommittee in 1988/89:

Status of the Narwhal, Monodon monoceros, in Canada. J.T. Strong. (AFSAC Document 88/89-05).

Status of the Western Hudson Bay Beluga, (Delphinapterus leucas) Populations. P.R. Richard. (AFSAC Document 88/89-06).

Stock Status Sheet for Southeast Baffin Beluga (Delphinapterus leucas). R. Stewart. (AFSAC Document 88/89-08).

Stock Status Sheet Canadian Eastern Arctic Bowhead Whale. E.D. Mitchell (AFSAC Document 88/89-11).

The Subcommittee also discussed a more efficient format for preparing documents for AFSAC and concluded that the stock sheet format could function both for the background report and final report on the individual stocks under review. A final version of this format and authors' guide will be prepared and sent to Sub-Committee members at a later date. Finally, the Subcommittee discussed the use of the term 'recruitment' in the marine mammal literature and concluded that commonly used terminology is often vague and inconsistent. It was recommended that the Subcommittee chairperson be responsible for preparing a glossary of terms, consistent with the terminology to be used in future background reports and the stock sheets. The glossary will be circulated among members of the Subcommittee and completed for inclusion in AFSAC's annual report for 1989/90.

In its re-evaluation of the southeast Baffin beluga, the Subcommittee considered the data available on harvests which have occurred since the first review of that stock by AFSAC in 1986/87. Those data indicated that the age structure of this stock (also referred to as Cumberland Sound stock) is truncated, with the large, old females being rare, likely as a result of selective hunting for large animals. The Sub-

committee concluded that current models for beluga which assume a normal age distribution may not be applicable to this stock.

Two fundamental problems must be addressed before Arctic marine mammal stocks can be managed with a degree of certainty. First, identification of stocks is probably the most critical management issue that must be resolved. This is especially apparent for beluga whales in Hudson Bay and Hudson Strait where up to four stocks may overlap in distribution during migratory and wintering periods.

Second, stock specific vital parameters are needed for all Arctic marine mammal stocks. Mortality and recruitment rates, based on studies of non-arctic odontocetes, are currently used to calculate total allowable harvests (TAH) of belugas and narwhals. This is clearly inadequate, given that population trends and, therefore, vital rates differ among marine mammal stocks. Should some vital rates, such as natural mortality, prove too intractable to estimate, perhaps there are other types of data that can be collected to permit assessment of population trends.

The Marine Mammal Subcommittee recommended that quotas be established on the basis of total allowable harvest (TAH) rather than total allowable catch (TAC). A quota based on TAH encourages efficient hunting to minimize the number of struck and lost animals and maximize the number of landed animals.

## SOUTHEAST BAFFIN BELUGA

### Introduction

AFSAC first reviewed this stock in 1986/87 and recommended re-evaluation in 1989 when results from aerial surveys during 1985 and 1986 were to be completed. These results were available in the fall of 1988, as was a draft assessment of the stock prepared for COSEWIC by Regional staff.

In the 1986/87 review, AFSAC's management recommendations were that it was desirable not to have a hunt of the stock to allow it to recover as quickly as possible to a level where a limited hunt would be sustainable. Second, AFSAC recommended that if there was to be a hunt, the total removal (landed plus lost) must not exceed 15 animals, representing 3% of the estimated population in 1986/87. Removal of less than 15 animals was preferred to ensure an adequate safety margin.

The new population estimate in 1988, based on the 1985 and 1986 surveys made it clear that the southeast Baffin stock was declining more rapidly than was thought earlier. A request was made for an urgent review of the stock by AFSAC, in anticipation of the need for DFO to further restrict or close the hunt entirely through revised regulations.

### Background

Stock definition: The southeast Baffin beluga stock concentrates in Cumberland Sound from late July to October. It includes animals which summer in Frobisher Bay, and there is strong circumstantial evidence that a portion of this stock also summers in the Lake Harbour area.

Stock size: Based on the 1985 and 1986 surveys, this stock was estimated to number about 500 beluga in 1986. With current rates of removal (108-142 per year), the stock would number about 400 by the end of 1988.

Vital parameters: Since the annual report for 1986/87, there has been no new information on vital parameters and the following is from that report:

| | |
|---|---|
| Female sexual maturity: | 5 yr |
| Calving interval: | 3 yr |
| Annual birth rate: | 7% of total population |
| Recruitment rate: | 2-3% of total population (based on published models of mortality for other odontocetes) |

Recruitment rates are based on population models which assume a reproductive life-span of 20 years for females and a stable age distribution. Based on a hunt which selectively harvests older animals, the oldest beluga identified in this stock was only 17 years, suggesting a truncated age distribution and abbreviated (approximately 12 years) reproductive life. Modelled birth and recruitment rates are therefore probably highly optimistic.

Current harvests: 1987 harvests were reported as: Pangnirtung 40; Iqaluit 36; Lake Harbour 34, for a total landed catch of 110. The proportion of the Lake Harbour harvest that comes from this stock is unknown. Harvest data for 1988 were: Pangnirtung 46; Iqaluit 44; Lake Harbour 9, giving a total landed catch of 99. Using an estimate for removal (landed catch plus struck and lost) of 1.09 to 1.43 times landed catch as discussed in the 1987/88 report of the AFSAC Marine Mammals Subcommittee, the 1988 harvest of 99 whales represents removal of 108 - 142, if all of Lake Harbour's catch is from this stock, and 98-129 if the Lake Harbour catch is excluded. Thus, the 1988 harvest represents 19.6% (98/500) to 28.4% (142/500) of the estimated 1986 stock size of 500, or 24.5% to 35.5% of the projected 1988 population of 400.

Other impacts: There is a potential for increased commercial shrimp fishing in eastern Hudson Strait, the presumed wintering area for this beluga stock. Nothing is known about the winter ecology of either the beluga or the shrimp, but it is likely that these whales feed on the shrimp, as beluga do on the Keewatin coast of Hudson Bay. An expanded commercial shrimp fishery may reduce the rate and degree of beluga recovery, and may even further endanger the stock at its current low level.

Major issues

Threatened stock: Hunting continues with the total removal greatly exceeding the replacement, even though the stock is small. The size of this stock raises serious concerns for its survival even with no hunting. It may have been reduced to close to the minimum viable stock size and is so small that "classical" population theory does not apply; each individual is now very important. The stock is certainly too small to have a buffer of numbers protecting it from natural events such as entrapments or epidemics.

Assessment

Stock prognosis: It is evident that current harvest levels will exterminate the stock before 1998, and that, even with total protection, the stock may never recover.

If the stock size is allowed to double from the 1988 estimate of 400 to at least 800, and the age structure returns to normal, the stock could presumably sustain an annual removal equal to replacement, currently estimated to be 16 to 24 whales or 2-3%. However, it is advisable to let the stock size increase to a few thousand (e.g. 3 000), to provide an adequate buffer from the aforementioned natural hazards. There are no biological data on which to base a recommended stock size for this species. "Pre-exploited" stock size is irrelevant to the current management decisions because unknown ecosystem changes may have altered carrying capacity, and 'historical' levels may no longer be attainable.

Management recommendations

1. If the population is to recover, there should be no harvest, through total cessation of beluga hunting in Pangnirtung and Iqaluit, and closure of the beluga season in Lake Harbour during June to October (the time when the southeast Baffin stock is likely to be in Lake Harbour).
2. The stock size should not be allowed to fall below the current level. The ability of this stock to sustain any harvesting whatsoever is uncertain.

Research requirements

1. Morphometric data including gender and age should be obtained from all whales harvested at Lake Harbour to compare with similar data from the beluga harvested at Pangnirtung, as well as the whales from the Hudson Bay stocks to clarify uncertainties in stock identification.
2. Suitable passive, surface-to-surface telemetry and satellite telemetry tags need to be developed and deployed at Pangnirtung to determine the beluga migration and distribution patterns.
3. DNA "fingerprinting" techniques need to be refined and implemented so that biopsies can be used for stock identification of this species and, possibly for mark-recapture estimations of stock size.
4. Complete population surveys should be carried out in 1994 and 1995 to assess the impact of an anticipated hunting moratorium.
5. The winter ecology of the beluga needs to be examined to assess the impact of a commercial shrimp harvest.

Next AFSAC review

The next review is recommended for 1992, provided that the management recommendations are implemented and some of the research requirements are carried out.

WESTERN HUDSON BAY BELUGA

Introduction

This stock was last reviewed by AFSAC in 1986/87. Information available at that time indicated that the stock numbered between 7 000-11 000 whales. The relationship between the beluga in western Hudson Bay and those in Hudson Strait and eastern and northern Hudson Bay was uncertain.

Results of an aerial survey of western Hudson Bay beluga conducted by DFO in 1987 have since become available. The stock was reviewed again in light of new data on stock size and discreteness produced by this survey.

Background

Stock definition: The beluga of western Hudson Bay have previously been described as a stock separated geographically in summer from other stocks in eastern and northern Hudson Bay and elsewhere. New information indicates that, in mid-July, beluga are distributed all along the coast of NWT, Manitoba and Ontario from Eskimo Point to the mouth of James Bay. The western Hudson Bay beluga distribution is continuous with that described for the eastern Hudson Bay beluga. This casts some doubt over the existence of separate summer stocks in western and eastern Hudson Bay and suggests that some degree of exchange could occur during that time.

Stock size: Based on 1987 aerial surveys, the population is estimated to be 23 000 (95% CI = 10 300-58 300) to 28 000 (95% CI = 18 300-52 800) animals. This is more than double the previous estimates. These recent surveys were more extensive than the previous ones and covered the near-shore and offshore waters never surveyed previously.

Vital parameters:

| | |
|---|---|
| Female sexual maturity: | 5 yr |
| Calving interval: | 3 yr |
| Annual birth rate: | 7% of total population |
| Recruitment rate: | 2-3% of total population based on published models of mortality for other odontocetes and reproductive parameters of beluga |

Current harvest: Since the first report on this stock by AFSAC in 1986/87, no new harvest information has been made available.

An average of 236 beluga are landed annually in western and northern Hudson Bay. Eskimo Point, Churchill, Whale Cove and Rankin Inlet account for 115 per year, while the northern Hudson Bay catch from Chesterfield Inlet, Coral Harbour and Repulse Bay accounts for 121 per year. There are strong indications that a large proportion of the northern Hudson Bay catch comes from the western Hudson Bay stock. Loss rate has been estimated for other stocks at 8-30%, but the upper limit of this range is considered high for western/northern Hudson Bay. Using a range of loss rates of 8-20%, the western/northern Hudson Bay annual removal is estimated to be 1.09-1.25 times the landed catch, or 257-295 beluga; less than 1.3% of stock size. The western Hudson Bay stock is likely also hunted in Hudson Strait where catches average 329 beluga per year, but the proportion of that harvest which belongs to this stock is unknown. However, it is likely to be substantial since other stocks in the area are smaller than the western Hudson Bay stock. If 40% of the Hudson Strait harvest come from this stock this would add 164 (.40x329x1.25) to the estimated removal for Hudson Bay for a total maximum annual removal of 453 (164+295). The represents only 2% of estimated stock size. In addition, 2-4 beluga from this stock are captured live and sent to aquaria every year from the Churchill area.

Other impacts: Potential threats include chemical and acoustic pollutants linked to increased industrial development and vessel traffic in Hudson Bay. Hydroelectric development on the Nelson and Churchill rivers is causing changes in river flow and modifying water temperature and level in estuaries which are important summer habitat for beluga. Newly flooded land created by the dams for these projects also contributes to elevated levels of mercury in the water by the time it reaches the estuaries.

Commercial shrimp fishing may increase in the eastern Hudson Strait, the presumed wintering area for this beluga stock. Nothing is known about the winter ecology of either the beluga or the shrimp, but if these beluga feed on shrimp as they do on the Keewatin coast of Hudson Bay, there is a potential threat to the food resources of these whales and possible impact on the stock.

Major issues

Hydroelectric development: Potential disturbances to estuaries could result from ongoing hydroelectric developments (especially Nelson and Churchill River estuaries).

Quotas: There is at present no effective regulatory control on the harvest of this stock. If a high proportion of the Hudson Strait harvest comes from the western Hudson Bay stock, then removal may be at or near the recruitment rate. If removal reaches the recruitment rate, and quotas would be necessary.

Shared resource: The new information on distribution suggests that beluga are cosmopolitan in Hudson Bay and Hudson Strait and therefore should be viewed and managed as a shared resource by Keewatin, Baffin and Quebec Inuit. Unless this concept is assessed more fully, management measures may not be effective.

Assessment

Stock prognosis: Based on the above estimates of stock size, this stock is either increasing or stable.

Management recommendations

1. Total landed catch in western and northern Hudson Bay might exceed 236 beluga per year. Provisionally, a total allowable harvest (TAH) of 575 may be a safe level (23 000 x 0.025). This number is based on the lower population estimate (23 000) and a total removal of 2.5% (equivalent to the recruitment rate). More knowledge of migration routes, vital rates of the beluga and harvest levels in different areas is required to assign a more accurate TAH to this stock.
2. More precise estimates of the hunting losses are required since hunting conditions and techniques in Hudson Bay are different from those in other areas.

Research requirements

1. Telemetry studies are needed to investigate stock definition and migration patterns. These data could be used to estimate where and when these beluga are hunted outside of western and northern Hudson Bay. This information is required to more accurately determine harvest levels.
2. Stock-specific vital parameters need to be derived so that population trends can be identified and an appropriate TAH can be established.

Next AFSAC review

This stock should be reviewed again when research requirements (1 and 2 above) are met.

## CANADIAN EASTERN ARCTIC BOWHEAD WHALE

Introduction

Bowhead whales in the eastern Canadian Arctic were heavily harvested for commercial purposes until the early 20th century, at which time their numbers were much reduced from pre-exploitation levels. Since the close of the commercial hunt, subsistence harvest of this stock has occurred infrequently, but interest among the Inuit in exploiting this stock for subsistence purposes has been increasing. In response to questions about the possibility of hunting eastern Arctic bowheads, the status of the stock was reviewed to assess whether it could sustain a subsistence harvest at this time.

## Background

Stock definition: Bowhead whales (Balaena mysticetus) occur sparsely throughout the Canadian Arctic. The Canadian eastern Arctic stock occurs in two centers of abundance: one in Foxe Basin and northwestern Hudson Bay, the other along the eastern coast of Baffin Island northward into Baffin Bay, Lancaster Sound and dispersed in the channels and sounds of the Canadian archipelago. There is a geographic hiatus between this stock and the "Spitsbergen stock" at Cape Farewell, Greenland, and another between it and the "Bering Sea stock" at Dease Strait.

Whether bowhead in Hudson Bay/Foxe Basin area comprise a stock separate from bowhead in Davis Strait/Lancaster Sound area is not known. Until sufficient data are available to clarify this question, the best management approach is to treat the whales in these two areas as separate stocks.

Stock size: The Davis Strait stock was reported to number 11 000 in 1825; it is now reduced to as few as 75 or possibly as high as a few hundred animals.

The Hudson Bay/Foxe Basin stock was perhaps 500 in 1859; now it has been reduced to a minimum of tens of animals and a maximum of a few hundred.

Vital parameters: The following parameters are based on data from Bering Sea stock of bowhead whales:

| | |
|---|---|
| Female sexual maturity: | age is unknown, but the length of the animals is 13-14 m |
| Calving interval: | 3-6 yr |
| Annual birth rate: | 3.6-11.6% of total population |
| Recruitment rate: | unknown |
| Natural mortality rate: | unknown; 0.05-0.06% annually for other species of whales over 1 yr old |

Current harvest: There is presently no organized direct fishery. Desultory hunting between 1919 and 1976 resulted in an estimated one whale killed or struck every 2.5 years on average from the Hudson Bay stock, and one whale killed or struck every 11 years from the Davis Strait stock.

Other impacts: Parasites, disease and other aspects of natural mortality are unknown for these stocks. Ice entrapment is a known, but poorly documented cause of natural mortality. Food could be a limiting factor but an abundant biomass of copepods, chaetognaths and mysids still exists within the range of these bowhead. Predation by killer whales (Orcinus orca) occurs. Human-related impacts such as encroachment on critical habitat, harassment and acoustic, physio-chemical and other pollution, including uptake of contaminants and accumulation in tissues and organs may occur, but their presence and impact on bowheads are undocumented.

## Major issues

Endangered stock: This stock was severely depleted by commercial whaling and numbers do not seem to be increasing since whaling ceased.

Hunting: There is interest among communities in the eastern Canadian Arctic to harvest bowheads.

## Assessment

Stock prognosis: No data are available to evaluate trends in population abundance of either stock. Data required for this evaluation include information on possible reduction of genetic diversity and empirical data on current population levels.

## Management recommendations

1. No strikes or kills should be allowed from the Davis Strait/Lancaster Sound or Hudson Bay/Foxe Basin stock. These stocks appear to be too small and present knowledge of vital rates too scanty to recommend any harvest at this time.
2. Each nominal stock should be managed separately.

## Research requirements

1. Direct censuses of population abundance and estimates of annual birth rate should be made to accurately determine the current size and trends for both stocks.
2. Distribution patterns should be examined through satellite tagging to determine whether sub-stock groups such as summer feeding stocks exist. Such groupings if they are found to occur, could have an impact on management decisions.
3. Studies of genetic identity and diversity should be undertaken to answer questions about stock identity and discreteness.
4. Dead bowheads (whether due to natural causes or hunting) should be fully sampled to gather biological data on vital rates.
5. Behavioural and morphological comparisons between Canadian eastern Arctic stock(s) and the apparently recovering Bering Sea stock are needed. Such comparisons might yield clues to the apparent non-recovery of the former.

## Next AFSAC review

Next review should be done after one or more of the research requirements have been addressed. Presently there are no ongoing studies addressing any of the research recommendations.

# CANADIAN WESTERN ARCTIC BOWHEAD WHALE

## Introduction

This bowhead stock was depleted by commercial whaling and, although still considered to be endangered, may be recovering. In spite of the endangered status of these bowheads, the Alaskan Inupiat harvests this stock under the

management of the International Whaling Commission (I.W.C.). The Commission sets quotas based on the perceived subsistence needs of the Inupiat, but keeps them below the current estimated recruitment rate of the stock to facilitate stock recovery.

The Canadian Inuvialuit in Aklavik have requested a permit to hunt bowhead from this stock for subsistence purposes. The status of this stock was therefore reviewed to assess whether an additional harvest by the Inuvialuit could be sustained by the stock.

## Background

Stock definition: This stock is distributed in the Beaufort, Chukchi and Bering Seas as far west as Mys Billingsa and as far east as Amundsen Gulf. The permanent polar pack ice limits northern movements. The southern limit in the Bering Sea occurs in the vicinity of St. Lawrence and St. Matthew Islands. This population is also known as the Bering/Chukchi/Beaufort Sea stock. The southeastern Beaufort Sea is a major summering area for this stock.

Stock size: In 1988, the Scientific Committee of the I.W.C. accepted a population estimate of 7 800 (95% confidence interval 5 700-10 600) whales based on a combined visual and acoustic census of bowheads migrating past Point Barrow, Alaska in the spring. The accuracy of this estimate is currently being reviewed by DFO's scientists, but the number does represent the best available information. This stock is still considered to be endangered.

Vital parameters: Unless otherwise indicated, the following parameters are taken from those estimated for the Bering Sea stock by Mitchell and Reeves (1986).

| | |
|---|---|
| Female sexual maturity: | age is unknown; but length of the animals is 13-14 m |
| Calving interval: | 3-6 yr |
| Annual birth rate: | 3.6-11.6% of total population |
| Recruitment rate: | 1.3% of total population (IWC Rep. of 40th Meeting, 1988) |
| Natural mortality rate: | unknown |

Current harvest: No Canadian harvest occurs but the Alaskan Inupiat obtain a quota from the I.W.C. In 1988, the I.W.C. approved a quota of 44 whales struck or 41 whales landed for the period 1988-1990.

The I.W.C. has estimated a 1 to 3% replacement yield (recruitment rate) and sets its quota as a proportion of this value. The current Alaskan quota represents 0.8% (44/5 700) to 0.4% (44/10 600) of the total estimated population.

Other impacts: Hydrocarbon development along the Alaskan North Slope and in the Mackenzie Delta may interfere with the migration and feeding patterns because of the disturbance effects of underwater noise generated by vessel and drilling activity.

Sources of natural mortality, including disease, predation, and ice entrapment are not well documented. Effects of environmental contaminants are also unknown. The distribution of summering whales appears to be correlated with the distribution of dense aggregations of copepods, thus any factor limiting the abundance of plankton could adversely affect bowhead whales.

## Major issues

Endangered stock: This stock was depleted by commercial whaling. Current population trends are not known because census techniques have not been adequately standardized.

Hunting: The community of Aklavik has submitted a proposal to harvest a bowhead in the summer of 1989.

## Assessment

Stock prognosis: No data are available to evaluate population trends. Although the 1988 estimate of 7 800 is larger than the 1984 estimate of 3 871 (±254) whales, it is based on a new census technique which includes both visual and acoustic 'sighting' data. This new technique is currently being investigated to determine the accuracy of the new higher population estimates.

## Management recommendations

1. The I.W.C. has estimated the minimum annual replacement (recruitment) rate to be about 1% of the total stock size or 56 whales. This is the maximum allowable harvest that would permit the stock to remain stable. The current I.W.C. quota allows 44 strikes/year, thus an additional harvest of 12 bowhead would not exceed the total harvest level of 56 whales. Based on current estimates, a total allowable harvest (TAH) of 56 whales would permit the Bering Sea stock to remain stable. Should a Canadian harvest be approved, it is recommended that the additional removal (landed and lost) be less than 12 whales.
2. The Bering Sea bowhead stock occupies waters whose jurisdiction is shared by the U.S.A., U.S.S.R. and Canada. It is presently managed by the I.W.C. and hunted only by the Alaskan Inupiat. It is recommended that management initiatives take the international status of this stock into consideration.

## Research requirements

1. The current technique being used to count migratory bowheads (visual and acoustic siting) should be evaluated so that the accuracy of current stock size estimates can be determined and confidence intervals established.
2. The Department should derive its own method of censusing bowhead populations. Application of DNA fingerprinting as a variation of a mark-recapture technique should be investigated.

3. Distribution and movement patterns should be studied to determine how bowheads use their habitat and how they may be affected by vessel noise and other aspects of industrial activity. Satellite tags are being developed and a tagging program is in the planning phase.
4. Dead bowheads should be fully sampled to gather data on vital rates. This includes any bowhead harvested by the Inuvialuit in a subsistence hunt.

Next AFSAC review

Next review should be done in 1991 when more research has been initiated and at least some preliminary results are available.

HIGH ARCTIC NARWHAL

Introduction

This stock was reviewed by AFSAC in 1986/87, however, more recent survey data on stock size has become available, as has data on landed catches and loss rates. The stock status of high Arctic narwhal was re-evaluated in view of these new sources of information.

Background

Stock definition: Three stocks of Arctic narwhal have been tentatively identified; one summering in northwest Greenland; one in the Canadian high Arctic and one in northwestern Hudson Bay. The high Arctic stock occurs in the waters and deep fiords of Baffin Bay and throughout the eastern Canadian archipelago. This stock is considered to be distinct and separate, as no evidence currently exists to prove otherwise.

Stock size: Based on unpublished 1984 aerial survey data, there are 17 900 (13 100 - 21 400) narwhals present in the four major summer concentration areas for the high Arctic stock: Eclipse Sound/Navy Board Inlet, Admiralty Inlet, Prince Regent Inlet and Peel Sound. This estimate is uncorrected for submerged animals and includes only the known areas of concentration.

Vital parameters:

| | |
|---|---|
| Female sexual maturity: | 6 yr |
| Calving interval: | 3 yr |
| Annual birth rate: | 7% of total population |
| Recruitment rate: | 2-3% of total population (based on population models for other odontocetes) |

Current harvest: Annual landed catch between 1976 and 1987 averaged 290 narwhals from all locations in the summering range. Loss rates range from 42 to 56%, resulting in a total removal of 1.72 to 2.27 times the landed catch or 499 to 658 narwhal on average per year from 1976-1986. These numbers represent 2.8 to 3.7% of the total population, more than the estimated recruitment.

Other impacts: Natural mortality is unknown. Lancaster Sound is the only feasible shipping route through the eastern Arctic and could assume major importance if the oil and gas industry in the Arctic becomes viable. Narwhal would be susceptible to industry related noise pollution. Chemical pollutants such as heavy metals and organochlorines may pose a potential threat. Accumulations of heavy metals and organochlorides in narwhal tissues are being investigated.

Major issues

Human population growth: There has been community pressure to increase narwhal quotas based on a perceived need for subsistence requirements by a growing human population.

Habitat disturbance: Increased harassment, the result of a growing human population in the Arctic and the modernization of hunting technology and methods could increase stress on the narwhal population by reducing the available undisturbed habitat. For example, the use of snowmobiles and power boats permit hunters to range over a greater area than before.

Some communities have expressed the fear that shipping activity is changing distribution patterns of the narwhal.

Fisheries interactions: There is an increasing interest in commercial marine fisheries, particularly for shrimp and halibut in Davis Strait. It is conceivable that such marine fisheries could adversely affect the narwhal food supply.

Assessment

Stock prognosis: The harvest of this stock exceeds the estimated recruitment rate of 2-3%. If the estimated stock size is accurate, the stock must be declining.

Management recommendations

1. Community quotas should be reassessed and set as total allowable harvests (TAHs) based on current knowledge of abundance and vital rates. TAH is composed of landed plus lost (struck) animals.
2. Community quotas should be two-tiered in that there are a number of strikes allowed as well as a number of landings. Total allowable harvests must be lowered to reduce total removal below the estimated net annual recruitment. The TAH should not exceed 448 narwhal.
3. Valid harvest statistics must be a priority. Ideally the harvest should be reported on a monthly basis with such information as strikes, landings, geographical location, home settlement, sex and approximate age of animal taken and date of harvest. The variability and problems of loss rate must be assessed.

Research requirements

1. Stock specific vital parameters are required to assess population trends. Use of

parameters based on other species is unacceptable.
2. Assessment of the impact of industrial activity on narwhal behaviour and distribution should be continued to produce baseline data for mitigation of effects of future industrial development.
3. A cost/benefit analysis of population surveys methods should be done to evaluate the coverage and precision required to detect population changes under various management regimes.
4. Stock identity should be determined by techniques such as mark-recapture, telemetry, genetics and organic and pollutant profiles.

Next AFSAC review

The next review by AFSAC is recommended for 1992, after more research on this stock has been completed.

## REPORT OF THE AFSAC FISH SUBCOMMITTEE: 1988/89

### INTRODUCTION

The 1988/89 meeting of the AFSAC Fish Subcommittee was held on 7 - 8 February 1989. Membership of the Fish Subcommittee in 1988/89 consisted of the following:

| | |
|---|---|
| J. Craig | (Science, Central and Arctic Region), Chairperson |
| A. Bodaly | (Science, Central and Arctic Region) |
| L. Johnson | (Science, Central and Arctic Region) |
| A. Kristofferson | (P&FF, Central and Arctic Region) |
| J. Reist | (Science, Central and Arctic Region) |
| C. Hudon | (Science, Quebec Region) |

At that meeting, the Subcommittee considered the following background reports:

Greenland Halibut of the Inshore Eastern Arctic. R. Crawford and L. Dahlke. (AFSAC Document 88/89-04).

Iceland Scallops in the Eastern Arctic. R. Crawford. (AFSAC Document 88/89-07).

Review of Keewatin Lakes. L. Johnson. (AFSAC Document 88/89-03).

Arctic Cisco, Coregonus autumnalis, in the Mackenzie River Basin - Stock Status Report. W.A. Bond and J.D. Reist. (AFSAC Document 88/89-02).

Status Report on Broad Whitefish Stocks of the Lower Mackenzie Basin, Northwest Territories. R.F. Baker and J.D. Reist. (AFSAC Document 88/89-01).

Stock Status Report of Arctic Charr Commercial Fisheries of Cambridge Bay, Northwest Territories. A. Kristofferson, D. McGowan, G. Carder and G. Low. (AFSAC Document 88/89-10).

Quota Recommendations for Commercial Fisheries of Anadromous Arctic Charr, Northwest Territories, 1989/90. A. Kristofferson, G. Low, D. Pike, and B. Stewart. (AFSAC Document 88/89-11).

The Subcommittee's mandate was to examine the foregoing reports on the stocks under review, report on the current status of stocks under examination, recommend rates of exploitation and other management policy based on present data and recommend aspects of research needed to improve the management of the stocks.

### GENERAL COMMENTS

Members of the Subcommittee expressed concern with the present form and extent of some background reports. They felt there was a need for more detailed biological information on the species under consideration.

At the time of the meeting of the Subcommittee, the future role of AFSAC in freshwater fisheries in the NWT was unclear due to delegation of responsibilities for management of those fisheries to the government of the Northwest Territories. The future of freshwater scientific research in the area and the role that the Department of Fisheries and Oceans will play was also not clear. The Subcommittee felt that clarification would be necessary before suggestions could be made for subsequent review of freshwater fish stocks.

The 1987/88 AFSAC Fish Subcommittee report outlined the importance of an improved data base for the management of fisheries in the Arctic. It was stressed that there is a need for continuity in the collection of data. The present Subcommittee continues to endorse those recommendations. In particular, the importance of genetic stock identification, collection of sound catch statistics and the study of recruitment cannot be over-emphasized.

The Subcommittee thanks all those involved in the preparation of the background reports for their untiring efforts. It recommends, and urges strongly, that these documents be prepared for publication in the Canadian Fisheries and Aquatic Sciences Technical Report series, or other suitable publications, if and when appropriate.

The following sections review the background documents, and provide a statement of the conclusions and recommendations of the Fish Subcommittee.

### GREENLAND HALIBUT OF THE INSHORE EASTERN ARCTIC

Introduction

The Greenland halibut (Reinhardtius hippoglossoides), also known as turbot, represents about 2% of the annual catch of all fish species by fisheries in Atlantic Canada. These fisheries, off Newfoundland and in the Gulf of St. Lawrence, become active in April. A fishery in Greenland takes place several months before this and a premium price is obtained by supplying the product to the Canadian markets early. Northern Canadians on Baffin Island became aware of a

potential opportunity for halibut sales since the Greenland product passed through Iqaluit, NWT, on the way to southern markets.

The Hunters and Trappers Association (HTA) in Pangnirtung, NWT, began test fishing for Greenland halibut in Cumberland Sound during the summer of 1985. Longlines were used but the fishery was unsuccessful. Winter fishing with longlines through landfast ice in 1986 produced 186 halibut (5-6 kg mean weight) in a few days. Summer fishing in 1986 was unsuccessful, thus it was surmised that the halibut leave Cumberland Sound in summer and return in fall.

During January to April, 1987, the experimental fishery caught and processed 4 100 kg of Greenland halibut under a provisional quota of 6 000 kg. About two-thirds of the product was marketed in Yellowknife and Ottawa. The 1988 harvest was 10 600 kg and most of the product was shipped to Montreal and Ottawa.

Greenland halibut have been taken as an incidental catch by subsistence fisheries at other Baffin Island communities such as Pond Inlet, Clyde River and Broughton Island, as well as Grise Fiord on Ellesmere Island. Attempts have been made to establish a summer turbot fishery based at Killinek Island. Success has been greatest in the offshore waters judged too distant for the local inshore fleet. Recently, communities in Northern Quebec have started to develop plans to evaluate winter turbot fisheries along the southern shore of Hudson Strait as a result of the success of the Pangnirtung fishery.

## Background

Stock definition: Greenland halibut taken in the eastern Arctic are assumed to be part of the Davis Strait stock. The halibut appear to migrate into Cumberland Sound in winter and return to Davis Strait in summer.

Stock size: Little is known about the size of the Davis Strait halibut stock.

Vital parameters: Based on data from the 1987 Cumberland Sound fishery, modal length was 700 mm and ranged from 425 to 1 050+ mm. Most of the catch (60%) was 575-725 mm. Modal age was 9 years and ranged from 7-16 yr. Most of the catch (73%) was 9-11 yr. Instantaneous total mortality for ages 11-15 yr was 0.88. Annual survival was 41%. The von Bertalanffy growth parameters (Bertalanffy, 1938) were: $L_{\infty}$ = 4 878 mm, K = 0.013 and $t_0$ = -0.886. Mean weight for 1987 as 3.6 kg and for 1988, 5.0 kg. More data are required to obtain a realistic $L_{\infty}$ value.

Current harvest: A total allowable catch (TAC) of 12 500 metric tonnes (mt) was assigned for the Davis Strait halibut fishery (NAFO area 0) according to the Atlantic Groundfish Management Plan. Canada's share is 3 000 mt, of which 100 mt has been assigned to Baffin Island. This figure is divided into 50 mt for the Pangnirtung fishery in Cumberland Sound and 50 mt for other areas. If the latter is not utilized by other eastern Arctic fisheries, it reverts to the Pangnirtung fishery. Total reported catches for three years of fishing out of Pangnirtung are: 1986 - 1 000 kg, 1987 - 4 100 kg and 1988 - 10 600 kg.

Other impacts: Arctic charr has been reported to be the preferred bait for the Pangnirtung halibut fishery. Halibut meat was also utilized. The 1988 by-catch included Greenland shark, most of which was discarded, although 115 kg of shark meat was test marketed in Ottawa that year.

## Major issues

Increase in provisional TAC for Pangnirtung: Although the current TAC of 50 mt for Pangnirtung has not yet been harvested, proponents of fishery development feel it may be too low to obtain an adequate economic return. However, the existing processing facility in Pangnirtung is inadequate to cope with the existing TAC. As well, a dependable market has not yet been established due to competition in the south.

Fishery development in other areas: There is interest in developing a Greenland halibut fishery at other Baffin Island communities, as well as some along the north shore of Quebec.

Greenland shark fishery: There is interest within the Pangnirtung fishery in developing a market for Greenland shark.

## Assessment

Stock prognosis: Current levels of exploitation of Greenland halibut by eastern Arctic fisheries are not likely to significantly affect the Davis Strait stock. The 100 mt TAC assigned to Baffin Island is believed to be sustainable. A re-evaluation may be necessary with the development of other fisheries.

## Management recommendations

1. The present 100 mt TAC for Baffin Island fisheries is appropriate at present (1988) fishing levels.

## Research requirements

1. Biological data needs to be gathered annually from a sample of the catch from the Pangnirtung halibut fishery. Data reporting needs to be standardized to avoid the inaccuracies and discrepancies encountered in the past. The results should be analyzed in the context of research protocols developed by the halibut research group of DFO in the Newfoundland Region.
2. There is a need to determine whether the halibut taken in the Baffin Island area are indeed part of the David Strait stock, prior to consideration of increases in the TAC for Baffin Island fisheries.
3. A research vessel based in Iqaluit would facilitate investigations into stock identification and migration

patterns of Greenland halibut in the Baffin area as they relate to the Davis Strait halibut stock.

4. A background paper summarizing the current extent and knowledge of Greenland halibut and their fisheries is recommended for 1990. This information, as compared with current information on Greenland halibut from the Baffin Island area, could help to identify data gaps and areas for future research.

Next AFSAC review

The next AFSAC review of this stock should be in 1990, upon completion of the background paper.

ICELAND SCALLOPS IN THE EASTERN ARCTIC

Introduction

The discovery of Iceland scallops (Chlamys islandica) in Cumberland Sound in 1983 and 1984 during exploratory groundfish operations conducted by the Pangnirtung Hunters and Trappers Association created interest in developing a commercial fishery for scallops in that area. Test fishing since 1986 has revealed the presence of a number of beds in the Pangnirtung Fiord area and parts of Cumberland Sound. Exploratory fishing in the Ungava Bay/Hudson Strait area since 1983 revealed the presence of scallops of potential commercial value off Killinik and Akaptok Islands, and Quaqtaq. The possibility of developing commercial enterprises is being investigated. There are no commercial quantities of scallops at Lake Harbour or Frobisher Bay. The reported occurrence of scallops at Rankin Inlet has prompted some local interest.

Background

Stock definition: No information available. For fishery management purposes the scallops in Ungava Bay and Cumberland Sound are treated as separate stocks. For convenience, the fishery in each area should be treated independently.

Stock size: Generally unknown. Three areas in Ungava Bay contained in 1987 an estimated trawlable biomass of 4 266 mt whole scallops. There has been no other estimate of Iceland scallop population size for Arctic waters. An attempt is presently underway to derive preliminary estimates of scallop abundance in the Cumberland Sound area.

Vital parameters: The growth rate of Cumberland Sound scallops is slower than for Ungava Bay, and both are slower than that observed in the Strait of Belle Isle. The length-frequency distribution for scallops from the Cumberland Sound fishery showed a modal shell height of 76 mm. The main component of the catch was found to be 16+ years of age. Mean meat yield, in counts per 500 g, was 56.

Current harvest: The 1988 Cumberland Sound test fishery ran from 29 September to mid-November. Available data indicate 4 689 gallons of whole, live scallops were harvested up to 16 October. This represents approximately 160 000 scallops or 12.7 mt round weight.

Other impacts: There is interest in developing a shrimp fishery in the south Baffin Island area, possibly using traps for Sclerocrangon boreas, a benthic species. Towed scallop dredges may disrupt the bottom habitat, but due to the localized fishing activity for scallops, it is unlikely that the impact will be widespread.

Major issues

Survey of other areas: Interest has been expressed by other Baffin Island fishermen in having their local waters surveyed for concentrations of Iceland scallops.

Increase in provisional TAC for Cumberland Sound: Although the Pangnirtung scallop fishermen have not yet harvested the provisional TAC of 100 mt for the Cumberland Sound area, a larger TAC may be required to permit a suitable economic return.

The currently available data are being analyzed to determine whether an increase in the present TAC would be within the biological limits of the stock's productivity.

Assessment

Stock prognosis: The size of the Cumberland Sound Iceland scallop stock is not known, nor is its response to different levels of exploitation. Its slow growth compared with Ungava Bay and more southerly scallop stocks suggests its productivity is limited.

Management recommendations

1. TAC in Cumberland Sound should not exceed the present level of 100 mt until biological data indicate otherwise.
2. A fishing strategy should be developed for the Cumberland Sound Icelandic scallop fishery (for example, sustained long-term fishery or pulse fishery).

Research requirements

1. There is an immediate need for accurate estimates of the density and distribution of scallop beds.
2. Survey procedures need to be standardized for comparability. More information should be provided on effort data. Density estimates per unit of surface area should be attempted, as well as better delineation/mapping of available beds.
3. There is a need to develop the capability of ageing Iceland scallops within the Central and Arctic Region, particularly at the Iqaluit Area Office.
4. Detailed studies on the population dynamics of Iceland scallops in Arctic

waters should be initiated to determine sustainable exploitation rates.

5. A background paper summarizing the extent of current knowledge of Iceland scallops and their fisheries in general is needed. This information, as compared with current information on Iceland scallops in the Arctic, would help to identify data gaps and areas for future research.

Next AFSAC review

AFSAC should review this stock again in 1990 when the background report incorporating the latest survey and harvest data has been completed.

KEEWATIN LAKES

Introduction

This report represents a collation of the limited available information on a set of freshwater habitats of the District of Keewatin in the NWT. Keewatin contains one of the world's major lake districts with a relatively uniform distribution of tundra and lakes with the latter accounting for 30% of total surface area. There are 16 lakes over 500 km and 65 over 100 km in Keewatin. There is little fishing activity in the area and, with minor exceptions, there has been no effective, substantive, or comprehensive research for the past 20 years, nor any effective management of the fisheries for the past 10 years. This has not in the past (the present report being an example), nor should it in the future, prevent the continued collection and collation of relevant information on an opportunistic basis in order to continue and to upgrade the biological inventory of lakes in this area.

Background - not applicable

Major issues - not applicable

Assessment - not applicable

Management recommendations

1. No recommendations were forthcoming.

Research requirements

1. A set of standardized methods for sampling necessary descriptive parameters should be developed and disseminated to all interested parties to ensure the results from any opportunistic studies will be comparable. The author of the background report should prepare appropriate methodologies as intended and include these in the manuscript for publication. Implicit in this is the encouragement to the author to publish the manuscript as soon as feasible.
2. A centralized repository for the information in the form of an appropriate data base should be found and notification of this made to all interested parties.
3. The aquatic systems of interest should be examined, reported upon, and analyzed from an appropriate natural basis such as a drainage basin, rather than some convenient political or physiographic region. That is, "Keewatin Lakes" is an inappropriate descriptor in that it implies wider geographic coverage than in fact is so. The title should be altered to, for example - Lakes of the Hudson Bay drainage basin of the NWT.

Next AFSAC review

Due to the unclear consequences of delegation of management of freshwater fisheries to the Government of the Northwest Territories, no specific time for formal future review is possible. Upon resolution of the delegation issue, if sufficient work has been conducted in the area, AFSAC may wish to review the status of these lakes and the fisheries again in the mid-1990's.

ARCTIC CISCO IN THE MACKENZIE RIVER BASIN

Introduction

The Arctic cisco (Coregonus autumnalis) is a truly Arctic fish, being found only in Arctic drainages over much of the circumpolar area of the world. In Canada, it is found mainly in the Mackenzie River basin and adjacent coastal waters. In the Mackenzie basin, the Arctic cisco is found as far south as the Liard River in B.C. but is most abundant in the lower reaches. It is perhaps the most anadromous of the coregonid fishes, undertaking long distance migrations for feeding, spawning, and other life cycle requirements. It spends time in fresh water for spawning, egg incubation, and perhaps overwintering. The Arctic cisco is a relatively late maturing, long-lived species. It probably does not spawn every year after reaching maturity. Nothing is known concerning the genetic stock structure of Arctic cisco in Canadian waters.

There is no knowledge about the size of Canadian Arctic cisco stocks and there is only limited information about population dynamics parameters. At present, Arctic cisco are harvested commercially only in Alaska (Colville River); because of the possibility that the fish utilizing the Colville River may originate from the Mackenzie basin in Canada, this exploitation is of interest to Canadian fisheries managers. The Arctic cisco is exploited domestically throughout the lower Mackenzie. Due to the pattern of upstream migrations, single genetic stocks may be exploited successively by various fisheries, each taking place at different sites and different times. Little is known about present catch levels. Proposed hydroelectric developments in the upper Mackenzie basin represent significant threats to the Arctic cisco.

Background

Stock definition: There is no knowledge at present of the genetic stock structure of Arctic cisco stocks in Canada.

Stock size: There is no knowledge at present of the size of any Canadian stocks of Arctic cisco.

Vital parameters: There is little knowledge at present concerning the vital parameters of individual Arctic cisco stocks.

Current harvest: There are no commercial fisheries in Canada which specifically harvest the Arctic cisco. Commercial harvest occurs only in the Colville River delta in Alaska. Over the last 10 years, harvests in this fishery have averaged about 22 000 fish annually; the domestic harvest in this area may equal the commercial catch. The records of domestic harvests in Canada are incomplete and inadequate; total harvests may be in the area of 10 000 kg.

Other impacts: Due to the pattern of upstream migrations, single genetic stocks may be exploited successively by various fisheries taking place at different sites and different times. Other potential impacts include hydroelectric developments in the upper Mackenzie, dredging, acute and chronic toxicant spills and road construction.

Major issues

Information base: There is no data base which is organized on the basis of genetic stocks.

Status of individual stocks: There are probably at least five different genetic stocks of Arctic cisco in Canadian waters. There are no data for individual Canadian stocks.

Harvest documentation: There is a lack of historical and current data on the commercial and domestic harvest of Arctic cisco in Canada.

Unregulated domestic fisheries: All native and licenced non-native people are permitted to fish without spatial, temporal or physical restrictions. This has the consequence of concentrating fisheries on current-year spawners and leaving the large, non-mature segment of the population unexploited.

Transboundary issues: Because of the extensive migrations of the Arctic cisco, stocks cross territorial and international boundaries at various times in their life cycle. The fishery at Colville River may make a significant impact on a stock or stocks which are also harvested in Canadian waters.

Resource allocation: Stock quotas must be allocated such that total exploitation rates are maintained below population replacement rates.

Habitat: A wide variety of projects may affect Arctic cisco habitat. The "no net loss" habitat policy will protect the overall amount of the habitat, but the species may be genetically incapable of utilizing the replacement habitat area. The concept of "sources" and "sinks" may apply.

Assessment

Stock prognosis: The future prognosis of Arctic cisco stocks in Canadian waters is not possible at present with the extremely limited biological information available.

Management recommendations

Management of Arctic cisco stocks can only be carried out after existing knowledge has improved.

1. After genetic stock structure is determined, quotas should be set on an individual stock basis.
2. After genetic stock structure is determined, harvest statistics should be accumulated on an individual stock basis.
3. After genetic stock structure is determined, population dynamics parameters should be determined on an individual stock basis.
4. International and national allocation issues should be resolved.
5. An educational program should be initiated to inform local residents of aspects of fisheries biology and management.

Research requirements

1. Migration patterns require further elucidation.
2. Genetic stock structure needs to be determined to distinguish the stock origin of fish when they are in areas other than distinct spawning locations.
3. The distribution of stocks at the young and juvenile stages needs to be elucidated.
4. The populaton dynamics of exploited stocks needs to be investigated.
5. Experimental manipulation of Arctic cisco stocks should be undertaken.

Next AFSAC review

The next AFSAC review should take place in 1991.

BROAD WHITEFISH STOCKS IN THE LOWER MACKENZIE BASIN

Introduction

The broad whitefish (Coregonus nasus) is found only in Arctic drainages in northwestern North America and Siberia. It occurs as two or three distinct life history types. The broad whitefish is a relatively large, late maturing and long-lived species which probably does not spawn every year after reaching maturity.

Research over the last 20 years has been preliminary and has defined the biology, life history requirements, movements, and genetic stock structure of anadromous populations of broad whitefish in the lower Mackenzie River basin in general terms only. Seven separate genetic stocks of broad whitefish and their general spawning area can now be identified. There is some understanding of the general pattern of movements and habitat utilization of various life history stages.

The broad whitefish is probably the most important domestically fished species in the lower Mackenzie basin. The species is also sold commercially in the area. There is little biological data, and no information concerning harvest levels or population dynamics parameters for lower Mackenzie broad whitefish stocks. Because of the timing and geographic pattern of stock migrations, single genetic stocks may be exploited successively by various fisheries taking place at different sites at different times. At least some stocks are probably very heavily exploited. Proposed hydroelectric developments in the upper Mackenzie basin are possibly serious threats to the broad whitefish.

## Background

Stock definition: At least six distinct genetic stocks of broad whitefish can now be identified in the lower Mackenzie basin. These stocks are distinct from anadromous stocks in Alaskan rivers and from stocks in rivers east of the Mackenzie Delta.

Stock size: There has been no attempt to enumerate lower Mackenzie broad whitefish stocks.

Vital parameters: There is little knowledge at present concerning the vital parameters of individual broad whitefish stocks.

Current harvest: Domestic and commercial fisheries for broad whitefish overlap in the lower Mackenzie. Only those persons holding commercial licences are required to report catches. The domestic catch is probably much larger than the commercial catch, but it has been estimated by occasional studies only. A further complication in determining harvests is that statistics are recorded by administrative area, not on a genetic stock basis.

Other impacts: Due to the pattern of the upstream migration, single genetic stocks may be exploited successively by various fisheries taking place at different sites and different times. Other potential impacts include hydroelectric developments in the upper Mackenzie, dredging, acute and chronic toxicant spills and road construction.

## Major issues

Status of individual stocks: There are at least four distinct anadromous stocks, a minimum of two distinct lacustrine stocks, and at least one riverine stock of broad whitefish in the lower Mackenzie. There are no estimates concerning the size of any of these stocks, and little evidence concerning biological characteristics or population dynamics parameters for these stocks.

Information base: There is no data base which is organized on the basis of genetic stocks.

Harvest documentation: There is a general lack of domestic and commercial harvest data for lower Mackenzie stocks.

Unregulated domestic fisheries: All native and licenced non-native people are permitted to fish without spatial, temporal or physical restrictions. This has the consequence of concentrating fisheries on current year spawners and leaving the large, non-mature segment of the population unexploited.

The present commercial quota of 66 100 kg is not based on any biological data. It is based on combined species of broad and lake whitefish and spread over an area which does not reflect the true distribution of the stocks.

Transboundary issues and resource allocation: Individual genetic stocks cross territorial and traditional native boundaries. It is important to know harvest levels for each stock by each community.

Habitat: Numerous kinds of development projects could have potential impacts on broad whitefish habitat. The "no net loss" habitat policy will protect the overall amount of habitat, but the individual stocks that are affected may be genetically incapable of utilizing the replacement habitat area.

## Assessment

Stock prognosis: The future prognosis of broad whitefish stocks in Canadian waters is not possible at present due to the lack of biological information on individual stocks.

## Management recommendations

1. Individual quotas for broad and lake whitefish should be assigned. There would appear to be little impediment at present to the separate identification of broad and lake whitefish in the commerical fishing regulations. Quotas should include both domestic and commercial harvests.
2. Fishing areas should be realigned to reflect the distribution of known genetic stocks. It is recognized that fishing areas cannot be aligned on the basis of more than one species simultaneously, however, because the broad whitefish is the most important species throughout much of the lower Mackenzie, and because present genetic stock knowledge is most complete for this species, fishing areas could be aligned on the basis of the stock structure of the broad whitefish.
3. The implementation of test fisheries is recommended as a means to collect

the data necessary to establish commercial quotas. A test fishery proposed for 1989 is endorsed by the Subcommittee with the recommendation that it not exceed 16 000 kg and be carried out at Horseshoe Bend from mid-August to mid-September. Harvest statistics should be recorded for each species separately so that proportions of each in the catch can be determined.

4. Individual stocks should be enumerated and harvest statistics and exploitation rates should be calculated on a genetic stock basis.
5. A monitoring and regulatory program for domestic and commercial fisheries should be established.
6. An educational program should be initiated to inform local residents of aspects of fisheries biology and management.
7. Physical and biological characteristics of the broad whitefish fisheries should be monitored on a stock by stock basis.
8. Fishing effort should be relocated to reduce pressure on current year spawners.

Research requirements

1. Migration patterns of individual stocks need to be elucidated.
2. Genetic stock structure needs to be determined to distinguish the stock origin of fish when they are in areas other than distinct spawning locations.
3. The distribution of stocks at the young and juvenile stages needs to be elucidated.
4. The population dynamics of exploited stocks requires further investigation.
5. Experimental manipulation of broad whitefish stocks should be undertaken.

Next AFSAC review

The next AFSAC review should take place in 1992.

ARCTIC CHARR COMMERCIAL FISHERIES, CAMBRIDGE BAY, VICTORIA ISLAND

Introduction

The commercial fishery for Arctic charr at Cambridge Bay, Victoria Island began in 1960. It was based on the Ekalluk River in Wellington Bay and Freshwater Creek, flowing out of Greiner Lake, Cambridge Bay. The Ikaluktutiak (formerly Ekaloktotiak) Co-operative was formed to carry out this exploitation. Freshwater Creek quickly showed signs of over-exploitation, leading to closure by 1970.

The Ekalluk River reopened in 1973 with a reduced quota and, since that time, the fishery as a whole has produced 58 tonnes annually. This production is derived from the Wellington Bay Rivers of Ekalluk, Paliryuak, Halovik, and Lauchlan. In addition to the Wellington Bay systems, the Jayco River of Albert Edward Bay and the Ellice River on the mainland contribute substantially to the total fishery. Together, these rivers produce about 40% of the total commercial harvest of the NWT, which represents about 70% of total charr export sales.

Fishing is mainly by gillnet (minimum mesh size 139 mm, stretched) but a fish weir has been used experimentally on the Jayco River. Fish are transported to the Cambridge Bay processing plant by aircraft. There they are cleaned, graded and frozen, then shipped south by commercial air carrier.

The Department of Fisheries and Oceans has monitored the commercial operation since 1971. A detailed stock assessment was initiated in 1978.

Background

Stock definition: In 1967, the quota of 18 000 kg for the Ekalluk River was increased to 45 000 kg, but this included other locations in Wellington Bay for the first time. Although the other rivers (Paliryuak, Halovik and Lauchlan) were important, the greatest proportion of the catch still originated in the Ekalluk River. Between 1967 and 1968, the mean weight of charr from the Ekalluk River fell from 3.0 kg to 1.4 kg. This resulted in closure of this fishery. Although some stock interchange has been shown between the various rivers, the mean weight of charr in the Halovik River remained at 3.2 kg, suggesting the existence of a largely separate stock. As a security measure, the area quota was abandoned and separate quotas were placed on the individual rivers.

Tagging studies indicate that there is considerable movement between rivers in Wellington Bay, but that the Jayco River and the mainland rivers each support separate stocks. This is confirmed by differences in modal size, age structure and growth, despite the use of identical fishing gear in all fisheries. The Freshwater Creek stock (Cambridge Bay) is somewhat intermediate; of 808 charr tagged in 1982, 87% of the returns were made in the vicinity of tagging, 5% were recovered from the Lauchlan River, 4% from the Ekalluk River, and 4% from the Jayco River.

Stock size: Assessment of the abundance of an Arctic charr stock presents difficulties in that a proportion (estimated at between 2 and 4% of the migratory stock) does not go to sea in the year of spawning. Direct counts using a fish weir provided the following results:

| River | Year of count | Number |
|---|---|---|
| Wellington Bay | | |
| Ekalluk R. | 1979 | 183 000 |
| Halovik R. | 1981 | 21 000 |
| Lauchlan R. | 1983 | 11 000 |
| Paliruak R. | (possibly no run in this river) | |
| Albert Edward Bay | | |
| Jayco R. | 1981 | 139 000 |

Mainland Area
Ellice R. - No count to date
Perry R. - No count to date

Vital parameters:

WELLINGTON BAY STOCK COMPLEX:

Ekalluk River: Modal length of the run in 1988 was 550-600 mm, but the modal length of the commercial catch in 1988 was 600-650 mm, with a range of 450-800 mm. Fifty-eight percent of the catch was 600 mm or larger. The modal length represents a significant reduction from 1987. Modal age was 14 yr with a range of 8 to 21 yr. Mean weight was 3.0 kg. Instantaneous total mortality (15-19 yr) was 0.80.

Halovik River: Modal length of the run as a whole was 550-600 mm (range 200-800 mm). The modal length of the commercial catch was 650-700 mm (550-900 mm). Ninety-eight percent were 600 mm or larger. Eighty-seven percent of the sample (N = 163) was 14 yr of age, or older. Modal age was 16 yr and age ranged from 10 to 21 yr. Instantaneous total mortality (17-20 yr) was 0.65.

Lauchlan River: Modal length in the run was 600-650 mm (200-800 mm). The modal length of the commercial catch (N = 210) was 650-700 mm (500-900 mm). Ninety-eight percent of the charr in the sample were over 600 mm. Modal age was 16 yr (12-21 yr), 86% of the sample were 14 yr or older. Mean weight was 3.4 kg. Instantaneous total mortality (ages 17-20 yr) was 0.52.

Paliryuak River: Modal length of the commercial sample (N = 210) was 600-650 mm (500-850 mm). Ninety-one percent of the charr were 600 mm or larger. Modal age was 14 years (12-22 yr). Seventy-one percent of the charr in the sample were 14 yr or older. Mean weight was 2.8 kg. Instantaneous total mortality (15-21 yr) was 0.55.

JAYCO RIVER STOCK COMPLEX:

Jayco River: Modal length of the charr in the Jayco run was 550-600 mm (200-800 mm). Modal length of the commercial catch (N = 210) 650-700 mm (500-850 mm). Eighty-one percent of the catch was 600 mm or larger. Modal age was 16 yr (12-24 yr). Ninety percent of the charr were 14 yr or older. Mean weight was 3.0 kg. Instantaneous total mortality (18-22 yr) was 0.50.

MAINLAND AREA STOCK COMPLEX:

Ellice River: Modal length of the commercial catch sample (N = 210) was 600-800 mm (500-800 mm). Seventy-six percent of the charr were 600 mm in length or over. Modal age was 11 yr (8-15 yr). Three percent were 14 yr or older. Mean weight was 3.1 kg. Instantaneous mortality (12-15 yr) was 1.08.

Perry River: This river has not been fished since 1981. The following vital parameters are for that year. Modal length was 550-600 mm (500-800 mm). Forty-six percent of the charr were 600 mm or larger. Modal age was 11 yr (8-17 yr). Four percent were 14 yr of age or older. Mean weight was 3.2 kg. Instantaneous total mortality (12-14 yr) was 0.75.

Current Harvest: 1988 harvest data for the various rivers in the two areas are included in Table 5.

With the exception of Jayco River, harvests equivalent to quotas were taken at all locations. The Jayco River harvest was 1 780 kg short of its quota owing to harvesting problems (high water and inclement weather).

Other impacts: Meeting additional subsistence needs represents an estimated 5-6% of the harvest reported. Some itinerant anglers visit Ekalluk and Paliryuak rivers, but the harvest is small.

Major issues

Stock identification: The major issue lies in the identification of stocks within Wellington Bay. This is important because of the major contribution to the commercial fishery of the Wellington Bay rivers, and the confused nature of results to date. Jayco and mainland stocks appear to be relatively discrete.

Assessment

Stock prognosis:

WELLINGTON BAY STOCK COMPLEX: The fishery in Wellington Bay is largely dependent on the Ekalluk River and its massive freshwater system, but three other rivers systems are involved in this complex; Paliryuak, Halovik and Lauchlan rivers. In order to extend the season of the processing plant in Cambridge Bay, the fishery is divided into a "spring" (July) and "fall" (late August - early September) fishery. The spring fishery is largely composed of early fish moving downstream out of the Ekalluk River, and the fall fishery is largely fish about to ascend the river in question.

Ekalluk River: Between 1960 and 1970 the fishery had an annual quota of 37 000 kg. This quota was harvested annually, in addition to a substantial domestic catch. The total harvest was evidently in excess of the capacity of the system to produce, for in the late 1960's the fishery had to be closed for three years in order to allow stocks to recuperate. The annual harvest has subsequently been maintained at nearly 15 000 kg annually. The modal length of the fish remained quite constant until 1988 when a significant reduction occurred. In 1987 91% of the charr caught were over 600 mm in length, whereas in 1988, only 58% exceeded this value. There was a similar reduction in age: 75% of the charr were over 14 yr in 1978, compared with 61% over 14 yr in 1988.

There is abundant evidence from tagging studies that charr from the Ekalluk River spread out over Wellington Bay as soon as they move into salt water each spring.

Paliryuak River: It is believed that there is no indigenous population in the Paliryuak River, but charr from other systems certainly congregate at the mouth of the river in spring. The catch in this system shows a similar decline in modal length and age to that in the Ekalluk River. The modal length fell from 650-700 mm in 1987 to 600-650 mm in 1988.

Halovik River: This river is known to support a run of charr with 21 000 recorded in 1981. Modal age and length were apparently fairly constant until 1988 when modal length fell from 700-750 mm (1984-87) to 650-700 mm.

Lauchlan River: The charr in the Lauchlan River, as in the other rivers, experienced a rather sudden decline in size in 1988. The modal length was 700-750 mm (1984, 1985, and 1987) but declined to 650-700 mm in 1988.

Two main questions emerge: 1) to what extent are individual stocks attached to individual rivers and to what extent are they mixed and, 2) how is it possible to manage such a stock complex?

The downward shift in modal size in all three rivers simultaneously is very disturbing. It is evident that the situation needs very careful watching. A similar pattern for modal length constancy was observed in the Nauyuk Lake system as the stock declined, followed by a downward shift in modal length when the stock reached 10-20% of its original abundance.

Jayco River: This stock is considered to be the second largest stock in the region. The mean annual harvest over 13 years preceeding 1988 had been 11 000 kg. The modal length has varied somewhat but not in a manner to indicate over-fishing. The estimated rate of exploitation has been 4%. A fish weir has been used for harvesting which allows selection of the largest fish. In 1988 there was a significant drop in mean length with only 81% over 600 mm compared to 96% in 1987. This may be owing to the use of gillnets in 1988 on account of high water in the system.

Ellice River: The catch and quota fluctuated prior to 1984 but not in any consistent manner. Since that time, the quota has been taken and there has been a general increase in the modal age from 8 to 11 yr. There is no information on the total run. The stock does not appear to be in jeopardy.

Summary assessment: Exploitation appears to be heaviest within the Wellington Bay stock complex and some decline in size of the catch was noted amongst all fisheries. Exploitation is apparently lighter in the Jayco stock but again, some decline in size was noticed here as well. This is also true of the Mainland stock complex (Ellice River). These three stocks (Wellington Bay, Jayco River and Mainland) are believed to be discrete. The reason for this decline is as yet unknown, however, a cautious approach should be taken, especially with the Wellington Bay stock complex. It is therefore recommended that quotas (TACs) for 1989/90 remain the same as in 1988/89 for all locations. If exploitation appears to have increased in the Ekalluk River, and/or a continued decline in size is observed, a change in the fishing pattern is recommended.

Management recommendations

1. The following TACs are recommended for the Cambridge Bay commercial fishery in 1989/90:

| Location | TAC (kg round weight) |
|---|---|
| Ekalluk River | 14 500 |
| Paliryuak River | 9 100 |
| Halovik River | 6 800 |
| Lauchlan River | 9 100 |
| Jayco River | 13 600 |
| Ellice River | 6 000 |
| Perry River | 4 500 |

2. All the above fisheries need to be monitored in 1989/1990. Current exploitation rate at the Ekalluk River needs to be determined by examination of tag returns.

Research requirements

1. The existence of stocks at the Halovik and Lauchlan rivers should be confirmed using morphometric and genetic techniques on spawners from these two systems.
2. The degree of mixing of Arctic charr between systems during non-spawning years should be determined.
3. Studies should continue on the population dynamics of the eastern form of Arctic charr to better understand its response to exploitation.

Next AFSAC Review

February 1990.

QUOTA RECOMMENDATIONS FOR COMMERCIAL FISHERIES OF ANADROMOUS ARCTIC CHARR, NORTHWEST TERRITORIES 1989/90

The need for better catch statistics; both commercial and domestic is clearly needed and steps now in place to obtain these are supported by AFSAC. Considerable problems exist with stock identification. The quota recommendations given in Table 4 are endorsed, given the realization that they are the best available with present resources.

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Table 1. Domestic harvest statistics for beluga and narwhal in various areas of the Arctic.[a]

| | 1987 | | 1988 (preliminary) | |
|---|---|---|---|---|
| Area | Beluga | Narwhal | Beluga | Narwhal |
| Western Arctic | 144 | 0 | 116 | 0 |
| High Arctic | 59 | 157 | 137 | 196 |
| South Baffin/ Hudson Strait | 200 | 7 | 109 | 4 |
| Ungava Bay | -[b] | -[b] | -[b] | -[b] |
| West Hudson Bay | 231 | 17 | 190 | 37 |
| Eastern Hudson Bay | 28[b] | 0[b] | 20[b] | 0[b] |
| Total all areas | 662[c] | 181[c] | 572[c] | 237[c] |

[a]Source: IWC Report for Central and Arctic Region, DFO, for 1988, prepared April 1988.
[b]Incomplete information.
[c]Quantities are landed harvest with no corrections for lost or unreported harvest.

Table 2. Resident, non-resident and short term sport fishing licence sales Northwest Territories fifteen year trend.[a]

| Year | Resident | Non-Resident & Short Term* | Total |
|---|---|---|---|
| 1974-1975 | 6 723 | 3 945 | 10 668 |
| 1975-1976 | 7 716 | 3 659 | 11 375 |
| 1976-1977 | 7 491 | 3 580 | 11 071 |
| 1977-1978 | 9 242 | 4 123 | 13 365 |
| 1978-1979 | 9 590 | 3 938 | 13 528 |
| 1979-1980 | 9 175 | 4 011 | 13 186 |
| 1980-1981 | 10 656 | 4 468 | 15 124 |
| 1981-1982 | 11 484 | 3 962 | 15 446 |
| 1982-1983 | 11 402 | 3 289 | 14 691 |
| 1983-1984 | 10 842 | 3 421 | 14 263 |
| 1984-1985 | 12 656 | 3 363 | 16 019 |
| 1985-1986 | 13 281 | 3 626 | 16 907 |
| 1986-1987 | 11 909 | 3 284 | 15 193 |
| 1987-1988 | 13 502 | 3 802 | 17 304 |
| 1988-1989 | 13 353 | 3 363 | 16 716 |

[a]Source: Northwest Territories Sport Fishing Licence Sales, 1988-1989, Economic Branch, DFO, Central and Arctic Region, July, 1989.
*short term licences discontinued after 1976-1977.

Table 3. Approved schedule for AFSAC reviews: in FY 1989/90 and proposed schedule for AFSAC reviews in FY 1990/91.

| Year | Stock | Background Report Author(s) | Comments |
|---|---|---|---|
| 1989/90 Fish Subcommittee | Lake Whitefish: Chitty Lakes | E. Gyselman | |
| | L. Whitefish: Great Slave Lake | J. Clayton/M. Roberge | |
| | Arctic charr Keewatin | A. Kristofferson | |
| | Arctic charr in NWT | A. Kristofferson | annual summary |
| | Inconnu | R. Moshenko | |
| | Lake trout | M. Roberge | |
| | Lake Whitefish | J. Reist | |
| | Turbot: Inshore Eastern Arctic | R. Crawford | update of 1988/89 report |
| | Scallops: Inshore Eastern Arctic | R. Crawford | update of 1988/89 report |
| 1989/90 Marine Mammals Subcommittee | Walrus: Fox Basin | P. Richard/R. Stewart/ T. Smith | |
| | Walrus: Hudson Bay | P. Richard/R. Stewart/ T. Smith | |
| | Walrus: Hudson Strait | P. Richard/R. Stewart/ T. Smith | |
| | Beluga: East Beaufort Sea | T. Strong | |
| | Beluga: Lancaster Sound | S. Cosens/R. Stewart | |
| | Ringed Seal | S. Innes | |
| | Bowhead: Western Arctic | S. Innes | review of populations estimates in 88/89 report |

Table 3. (continued).

| Year | Stock | Background Report Author(s) | Comments |
|---|---|---|---|
| 1990/91 Fish Subcommittee | Arctic charr: Firth River | A. Kristofferson/ R. Baker | rescheduled from 1989/90 |
| | Arctic charr: Babbage River | A. Kristofferson/ R. Baker | rescheduled from 1989/90 |
| | Arctic charr: Rat River | A. Kristofferson/ R. Baker | rescheduled from 1989/90 |
| | Arctic charr: Hornaday River | A. Kristofferson/ R. Baker/R. Moshenko | rescheduled from 1989/90 |
| | Arctic charr in NWT | A. Kristofferson | annual summary |
| | Arctic grayling: Kakisa River | M. Roberge | rescheduled from 1988/89 |
| | Walleye: Mosquito Creek | - | from 1987/88 AFSAC review |
| | Turbot: Inshore Eastern Arctic | - | from 1988/89 AFSAC review |
| 1990/91 Marine Mammals Subcommittee | Bearded Seal | R. Stewart/ M. Kingsley | rescheduled from 1988/89 |
| | Harbour Seal | R. Stewart/ M. Kingsley | rescheduled from 1988/89 |
| | Harp Seal | R. Stewart/ M. Kingsley | rescheduled from 1988/89 |
| | Narwhal: Northern Hudson Bay | - | from 1987/88 AFSAC review |

Table 4. 1988/89 quotas and harvest and 1989/90 recommended quotas for the anadromous Arctic charr commercial fisheries in the Northwest Territories. Regions and numerical designations of water bodies follow that of Schedule V, Northwest Territories Fishery Regulations. Quotas and harvest figures are in kilograms round weight. Quotas in brackets are equivalent dressed weight. Note: For quotas marked *, round to dressed weight conversion factor is 0.80 and includes an estimate for subsistence take and cullage. For all other quotas, conversion factor is 0.87 since data on subsistence take and cullage are not available. NF = not fished, NA = not available at present.

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| REGION I - MACKENZIE DELTA | | | | |
| Hornaday River | not opened | NF | nil | Stock has been over-harvested in past. Important subsistence fishery here. Upstream run enumerated by weir in 1986. Run =16 000 charr. Commercial fishery not opened in 1987 or 1988 as a result. Investigations in 1987 and 1988 indicate stock has not recovered. Recommend fishery remain closed for 1989/90. Run should be enumerated again in near future to determine extent of recovery of stock. Subsistence fishery ongoing. Accurate harvest statistics are needed. |
| Mackenzie River Delta Area I | not opened | NF | nil | Charr from the Big Fish and Rat rivers are taken in this fishery. The Big Fish run was 9 100 charr, down from 21 000 in 1972. As a result river closed to all fishing in 1987 and 1988. Recommend fishery remain closed for 1989 and stock be enumerated in 1990 to determine extent of recovery.<br><br>Rat River stock believed to be heavily exploited by subsistence fishery. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Mackenzie River Cont'd | | | | Stock should be studied to determine current status. Recommend no commercial fishing on this stock in 1989. |
| REGION IV - CENTRAL ARCTIC | | | | |
| Agnew River Area | 4 500 | NF | 4 500 (3 900) | Apparently this system has not been fished at all for a number of years. Was requested for 1988/89 but not fished to date. |
| Arrowsmith River | 1 000 | 324 | 1 000 (900) | System overfished in past. Closed in 1982. Nominal quota of 1 000 kg established in 1988. Fishing reported to be poor. Status of stock unknown. Should be sampled in future. |
| Becher River | 1 000 | 998 | 1 000 (900) | Has been overfished in past. Quota reduced from 2 000 in 1986 to 1 000 in 1987 and 1988. Should be sampled in future. |
| Coppermine River | 600 | 600 | 600 (500) | Substantial subsistence fishery exists, as well as a sport fishery. Analysis of samples taken in 1981, 82, 85, 86 and 87 suggests that stock may be showing some signs of heavy exploitation. Mortality rate has risen and proportion of charr >650mm in catch has declined. Estimated annual harvest is 8-10 000 charr (subsistence 8-9 500, sport 250-300, commercial 200). Exploitation estimated at 9%. Tagging to determine current exploitation rate (and |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| | | | | size of stock) should be undertaken in near future. Recommend commercial quota remain at 600 kg. |
| Curtis River | 4 500 | NA | 4 500 (3 900) | No harvest data to date. Test fishery conducted on this system in 1986 and 1987. Test harvest was 1986-850kg, 1987-1 300 kg. Fishing takes place through ice in October/ November. Presence of large, old charr and low mortality rate suggest stock is lightly exploited at this time. Recommend quota remain at 4 500 kg. |
| Ekalluk River | 14 500 | 14 834 | 14 500 (11 600)* | See report on Cambridge Bay stocks. Recommend quota remain at 14 500 kg if present fishing patterns persist. Stock should be monitored annually. |
| Ellice River | 6 000 | 6 544 | 6 000 (4 800)* | See report on Cambridge Bay stocks. Recommend quota remain at 6 000 kg. Stock should be monitored annually. |
| Halovik River | 6 800 | 6 808 | 6 800 (5 500)* | See report on Cambridge Bay stocks. Recommend quota remain at 6 800 kg and fishery be monitored annually. |
| Jayco River | 13 600 | 11 820 | 13 600 (10 900)* | See report on Cambridge Bay stocks. Recommended quota remain at 13 600 kg and that this stock be monitored annually. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Keith Bay | 4 500 | 1 038 | 4 500 (3 900) | Fished lightly in past few years. Sampled in 1985. Stock appears to be satisfactory. Recommend quota remain at 4 500 kg. Low harvest in 1988 possibly due to low effort. |
| Kellett River | 1 000 | 998 | 1 000 (900) | Sampling in 1979 and 1980 indicated stock overexploited. Annual subsistence fishery accounts for approximately 1 800 kg. Sample in 1985 showed stock had not recovered. Should be sampled in future. |
| Kulgayuk River | 1 500 | NF | 1 500 (1 300) | Existence of stock uncertain. Opened on request in 1988 but not fished. |
| Lauchlan River | 9 100 | 9 425 | 9 100 (7 300)* | See report on Cambridge Bay stocks. Recommend quota remain at 9 100 kg. The fishery must be monitored annually. |
| Lord Lindsay Lake | 2 500 | 2 325 | 2 500 (2 200) | Listed as landlocked it should be sea run. Additional subsistence harvest of about 1 100 kg, plus a sport fishery. Quota lowered from 3 000 in 1987/88 to 2 500 in 1988/89. Harvest information for 1988/89 is complete. |
| Murchison River | 9 100 | NF | 9 100 (7 900) | Apparently not fished. No harvest reported. |
| Norway Bay | not opened | NF | 4 500 (3 900) | Not fished due to economics (distance from Cambridge Bay). |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Paliryuak River | 9 100 | 8 570 | 9 100 (7 300)* | See report on Cambridge Bay stocks. Recommend quota remain at 9 100 kg and stock be monitored annually. |
| Perry River | 4 500 | NF | 4 500 (3 600)* | See report on Cambridge Bay stocks. Requested to be open in 1988/89 but not fished. Recommend quota remain at 4 500 kg and stock be monitored if fishing takes place. |
| Port Parry | not opened | - | nil | Commercial fishery reported to be very poor due to low CPUE indicating a possible problem with the stock. Experimental sampling should be carried out in 1989. |
| Simpson River | 4 500 | NA | 4 500 (3 900) | Little is known of this stock. No harvest reported to date. |
| Stanwell-Fletcher Lake | 6 800 | 700 | 6 800 (5 900) | Estimated additional subsistence harvest of 1 000 kg. |
| Thomsen River Banks Island | not opened | - | 1 400 (1 200) | Little is known of this stock. |
| Unnamed River East of Ellice | not opened | - | nil | Existence of stock uncertain. No quota recommended at this time. |
| Unnamed River Dease Pt. | not opened | - | nil | Existence of stock uncertain. No quota recommended at this time. |
| Unnamed River & Lake | not opened | NF | 900 (800) | No interest in fishing. |
| Unnamed River Cape Adelaide | not opened | NF | 4 500 (3 900) | No interest in fishing. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Unnamed River Collinson Peninsula | not opened | NF | 4 500 (3 900) | No interest in fishing. |
| REGION V - KEEWATIN | | | | |
| Alden Lake & River | not opened | - | 900 (800) | None. |
| Baker Foreland Area | 4 600 | 4 414 | 4 600 (4 000) | Origin of stock unknown (possibly Josephine River). Sampled 1979, 1986, 1987, and 1988. 1988 modal size constant, modal age decreased from 11 yr to 9 yr. Fishermen agreed not to fish Josephine River if half the quota added to Baker Foreland. This was done in 1987. Stock identity should be confirmed by tagging. |
| Belcher Islands | not opened | NF | nil | Some recent interest in commercial fishing. No plans yet. |
| Bennett Bay Wager Bay | not opened | NF | 2 300 (2 000) | None. |
| Big River | 900 | NA | 900 (800) | Winter fishery. No harvest statistics to date. |
| Brown River | not opened | - | 6 800 (5 900) | None. |
| Chesterfield Inlet Fish Bay | 4600 | 5050 | 4 600 (4 000) | May be a need for tagging in this area to determine stock identity. Similar to Baker Foreland, half the Josephine River quota added to this area in 1987. Sampled 1987. Size similar to Baker Foreland, but modal age 10 yr. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Churchill River Area | 500 | NA | 500 (400) | None. |
| Christie Lake | not opened | - | 900 (800) | None. |
| Cleveland River Area | 6 100 summer | NA | 6 100 summer (5 300) | No harvest statistics available. |
| | 3 000 winter | NA | 3 000 winter (2 600) | No harvest statistics available. |
| Copperneedle R. | 4 500 | 1970 | 4 500 (3 900) | Sampled in 1988. Modal size 550-650 mm. Little is known of this stock. |
| Corbett Inlet | 4 500 | 5440 | 4 500 (3 900) | Sampled in 1988. Modal size 550-600 mm, modal age 9 yr. Quota exceeded by 900 kg in 1988/89. Should be monitored in 1989/90. |
| Diana Lake | not opened | NF | nil | Overwintering area for Diana River stock which has been overexploited. No quota recommended. |
| East Point | not opened | NF | 4 500 (3 900) | None. |
| Eskimo Point | 4 500 | 4 567 | 4 500 (3 900) | Sampled 1986. Modal size 550-600 mm, modal age 9 yr. Fishery comprised of only 3 year classes. Charr taken at this location and at Maguse River could not be distinguished due to close proximity of fisheries. Problem of stock identity. Tagging program recommended to determine stock identity. |
| Ferguson River | 13 600 | 4 950 | 13 600 (11 800) | Sampled in 1988. Data being analyzed. Harvest data incomplete as information on winter fishing not available. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Gibson Cove | not opened | NF | 2 300 (2 000) | None. |
| Gordon River | not opened | NF | 1 100 (1 000) | None. |
| Gore Bay | 3 600 | NA | 3 600 (3 100) | No harvest statistics to date. Possibly some winter fishing. |
| Hanway River | not opened | NF | 2 300 (2 000) | None. |
| Haviland Bay | 2 300 | NA | 2 300 (2 000) | No reported harvest. Possibly not fished in 1988/89. |
| Josephine River | not opened | NF | nil | Fishermen from Rankin and Chesterfield requested that this quota be split and half assigned to Baker Foreland and half to Chesterfield Inlet. Therefore, no fishing here. |
| Kamarvik Creek | not opened | NF | 2 300 (2 000) | None. |
| Maguse River | 4 500 | 3 022 | 4 500 (3 900) | Sampled in 1988. Problem with stock identity with Eskimo Point due to proximity of fisheries. Recommend tagging program in this area to determine stock identity. |
| Merle Harbour | 2 300 | NA | 2 300 (2 000) | Last sampled in 1986. Stock appeared to be in good condition. No harvest statistics to date on summer or winter fishery in 1988. |
| Mistake Bay | 2 300 | NA | 2 300 (2 000) | Problem with stock identity. No reported harvest for 1988. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| North Pole River | not opened | - | 2 300 (2 000) | None. |
| Peter Lake | not opened | NF | nil | Diana River stock overwinters in this lake. No fishery recommended. |
| Piksimak River | 2 300 | NA | 2 300 | No harvest statistics to date. |
| Pistol Bay | 600 | 1 707 | 2 300 (2 000) | Sampled in 1988. Stock appeared stable. Modal size 550-600mm. Modal age up to 10 yr from 9 yr in 1986. |
| Ranger Seal Bay | 9 100 | NA | 9 100 | No harvest statistics to date. |
| Rankin Inlet | not opened | NF | nil | This fishery was closed in 1985 due to overexploitation. Residents of Rankin Inlet agreed to reduce the subsistence catch. The angling limit was reduced from 4 and 7 to 2 and 4. The stock was assessed using a fish weir on the upstream migration in 1986. Numbers and size were both down compared with historic levels. A recovery strategy is now in effect. Commercial fishery should remain closed. Test samples (139 mm mesh gill net) taken in 1985, 1986, 1987 and 1988. Modal size up to 550-600 mm in 1986, 1987 and 1988 from 500-550 in 1985. Modal age up to 9 yr in 1986 and 1987 and 10 yr in 1988 from 8 yr in 1985. Stock appears to be recovering. Field Services, Iqaluit, to investigate establishing |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Rankin Inlet Cont'd | | | | minimum gillnet mesh size for subsistence fishery at 139 mm, and to ban all gill netting on downstream run. Harvest statistics for sport and subsistence fisheries must be kept. Stock enumeration by weir is recommended in 1990 to determine extent of recovery. |
| Robin Hood Bay | 6 800 | 1 540 | 6 800 (5 900) | Harvest reported here is for summer fishery only, no data on winter fishery. Sampled in 1988. Modal length 550-600mm, modal age 10 yr. Stock does not appear to be heavily exploited. Remainder of quota open for winter fishing. |
| Sandy Point | 900 | 900 | 900 | Stock is believed to be small. |
| Snowbank River | 2 300 | NA | 2 300 (2 000) | No reported harvest to date. Possible winter fishery. |
| Steep Bank Bay | 4 500 | 16 | 4 500 (3 900) | Last sampled in 1986. Modal size 550-600 mm, modal age 9 yr. Low harvest may be due to low effort. |
| Stoney Point Area | 6 800 | 3 257 | 6 800 (5 900) | Sampled in 1988. Modal size 500 to 650 mm. Modal age 10 yr. Has not been fished until recently. Stock appears to be in good condition. Reported harvest from summer fishery only. Also opened for winter fishery. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Thomsen River | 8 400 | 2 300 | 4 200<br>(3 700) | Assessment using weir in 1987 indicated run of 15 500 charr. Stock appeared to be lightly exploited. Fishermen requested that this location be fished every two years due to economics. Thus, quota doubled (8 400) for 1988/89. Apparently not fished. TAC of 4 200 kg recommended. |
| Wallace River | 2 300 | NA | 2 300<br>(2 000) | No reported harvest statistics. Possibly not fished. |
| Whale Cove Area | not opened | - | nil | Combined with Wilson Bay. |
| Wilson Bay | 7 000<br>summer<br><br>3 000<br>winter | 5 178<br><br>NA | 7 000<br>summer<br>(6 100)<br>3 000<br>winter<br>(2 600) | Combined with Whale Cove as only one stock suspected to be present in these areas. Last sampled 1986. Modal size 550-600 mm, modal age 9 yr. No harvest data received from winter fishery to date. |
| Unnamed River | not opened | - | 2 300<br>(2 000) | None. |
| Unnamed River | not opened | - | 2 300<br>(2 000) | None. |
| Unnamed River | not opened | NF | 6 800<br>(5 900) | None. |
| Unnamed River | not opened | NF | 6 800<br>(5 900) | None. |
| Unnamed River<br>Wager Bay | not opened | NF | 2 300<br>(2 000) | None. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| REGION VI - BAFFIN - HIGH ARCTIC | | | | |
| Adams Island Lake & River | not opened | NF | 700 (600) | None. |
| Amadjuak Lake | not opened | NF | 9 100 (7 900) | No interest in fishing. |
| Blandford Bay River | not opened | NF | 900 (800) | None. |
| Cape Adair | 2 300 | NA | 2 300 (2 000) | Possible winter fishery. No reported harvest to date. |
| Clyde Inlet | not opened | NF | 2 300 (2 000) | None. |
| Cockburn River | 5 000 | NA | 5 000 | Fishery still open. No reported harvest to date. |
| Coutts Inlet | not opened | NF | 900 (800) | None. |
| Drewry River Lake Gillian | not opened | NF | 3 200 (2 800) | None. |
| Duart Lake & River | not opened | NF | 700 (600) | None. |
| Eque Bay Area | not opened | NF | 900 (800) | None. |
| Feachem Bay Lake & River | not opened | NF | 900 (800) | None. |
| Freshwater Lake | 4 500 | 4 200 | 4 500 (3 900) | Fishing good. Stock should be sampled in future. |
| Gifford River | 3 600 | 3 800 | 3 600 (3 100) | Winter fishery. |
| Hall Lake | 9 000 | 4 455 | 9 000 (7 800) | Level of subsistence harvest 4 000 kg annually. Stock considered large and not heavily fished. Commercial quota increased from 3 600 kg to 9 000 in 1988/89. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Ikaluit River Tay Sound | 2 300 | NA | 2 300 (2 000) | Subsistence harvest 1 800 kg. Should be sampled 1989. No harvest statistics to date. |
| Ikalojuak Bay area | not opened | NF | nil | Residents of Pangnirtung request this fishery remain closed. |
| Irvine Inlet | 4 500 | NA | 4 500 (3 900) | Should be sampled 1989. No harvest statistics to date. |
| Isortog River | 5 000 | NA | 5 000 | No harvest statistics to date. |
| Kingnait Fjord | 4 500 | 5 790 | 4 500 (3 900) | Sport fishery as well as commercial. Should be sampled in near future. 1988 quota exceeded by 1 300 kg. |
| Kipisa Lake | 1 400 | 545 | 1 400 | Partial harvest statistics only on winter fishery. |
| Kukaluk River | 3 600 | NA | 3 600 (3 100) | No harvest statistics to date. |
| Lethbridge Lake & River | not opened | NF | 1 400 (1 200) | None. |
| Nedlukseak Fjord | not opened | NF | 3 600 (3 100) | None. |
| Newton Fjord Area | not opened | NF | 2 300 (2 000) | None. |
| Nettilling Lake | 22 700 | NA | 22 700 (20 000) | Winter fishery possible. No reported harvest to date. |
| Nudlung Fjord | 4 500 | NA | 4 500 (3 900) | Some subsistence fishing (1 000 kg). No reported harvest statistics to date. |
| Okalik Bay | 1 400 | 1 300 | 1 400 | Quota increased from 900 kg in 1987/88 to 1 400 kg 1988/89. Stock appears to be in good condition. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Padle River | 3 600 | NA | 3 600 (3 100) | No reported harvest statistics to date. 1 400 - 1 800 kg subsistence harvest. |
| Padle Fjord | 3 600 | NA | 3 600 (3 100) | No reported harvest statistics to date. Apparently 2 000 kg subsistence harvest. |
| Padloping Island | not opened | NF | 900 (800) | None. |
| Paquet Bay River & Lake | 1 000 | NA | 1 000 (900) | Some concern over small size of fish. Quota reduced from 2 300 kg to 1 000 kg in 1985. Winter fishery in progress. No reported harvest statistics to date. |
| Phillips Creek | not opened | NF | nil | No interest in fishing. |
| Piling Lake & River | not opened | NF | 1 800 (1 600) | None. |
| Qualluatik Lake | 700 | NA | 700 (600) | Winter fishery. No harvest statistics to date. |
| Ravn River | 9 100 | NA | 9 100 (7 900) | Winter fishery. No harvest statistics to date. |
| Rowley River | 5 000 | NA | 5 000 | No harvest statistics to date. |
| Sam Ford Fjord | 3 600 | NA | 3 600 | Winter fishery plus small subsistence fishery (900 kg). No harvest statistics to date. |
| Saputing River | 9 100 | 2 571 | 9 100 (7 900) | Partial harvest statistics only on winter fishery. |
| Tarsuaq Arm | 2 500 | NA | 2 500 | No harvest statistics to date. |
| Tasialojuak Lake | not opened | NF | nil | No interest in fishing. |

Table 4. (continued)

| Waters | 1988/89 Quota | 1988/89 Harvest | 1989/90 Recommended Quota | Comments |
|---|---|---|---|---|
| Tugat River | 1 000 | NA | 1 000 (900) | Concern about small size of fish. Quota reduced to 1 000 kg in 1985. Should be sampled in 1989. No reported harvest statistics to date. |
| Whyte Lake & River | 900 | NA | 900 (800) | Possible winter fishery. No reported harvest statistics to date. |
| Unnamed River (God's Mercie) | not opened | NF | 900 (800) | None. |
| Unnamed Fjord | 1 400 | 1 100 | 1 400 | Good production in the past two years. |
| Unnamed River (Kekertelung Is.) | not opened | NF | 2 300 (2 000) | None. |
| Unnamed River | 1 400 | NA | 1 400 (1 200) | Fishing reported as poor in past. Should be sampled in near future. Possible winter fishery. No reported harvest statistics to date. |
| Unnamed Lake (Dexterity Fjord) | 900 | NA | 900 (800) | Winter fishery. No reported harvest statistics to date. |
| Unnamed Lake & River (Dexterity Fjord) | 500 | NA | 500 (400) | Winter fishery. No reported harvest statistics to date. |
| Unnamed River & Lake (Kentra Bay) | not opened | NF | 500 (400) | None. |
| Unnamed Lake & River (Styrmann Is.) | not opened | NF | 900 (800) | None. |
| Unnamed River | 2 500 | NA | 2 500 (2 200) | Winter fishery. No reported harvest statistics to date. |

Table 5. 1988 harvest data for commercial Arctic charr fisheries at Cambridge Bay, Victoria Island.

| Location | 1988 Quota (kg) | 1988 Harvest (kg) | Mean Wt. (kg) | No. of Fish |
|---|---|---|---|---|
| Wellington Bay | | | | |
| Ekalluk R. | 14 500 | 14 834 | 3.0 | 4945 |
| Paliryuak R. | 9 100 | 9 425 | 2.8 | 3366 |
| Halovik R. | 6 800 | 6 808 | 3.4 | 2002 |
| Lauchlan R. | 9 100 | 9 425 | 3.4 | 2772 |
| Jayco R. | 13 600 | 11 820 | 3.6 | 3283 |
| Mainland area | | | | |
| Ellice R. | 6 000 | 6 544 | 3.1 | 2111 |
| Perry R. | 4 500 | ---------- | not fished | ---------- |
| Perry | 6 800* | 2 836* | 3.2 | 886* |

* Most recent commercial harvest

Appendix 1. List of AFSAC Background Documents for 1988/89.

1988/89 Background Documents

88/89-01 Status Report on Broad Whitefish Stocks of the Lower Mackenzie Basin, Northwest Territories. R.F. Baker and J.D. Reist.

88/89-02 Arctic cisco, Coregonus autumnalis, in the Mackenzie River Basin - Stock Status Report. W.A. Bond and J.D. Reist.

88/89-03 Review of Keewatin Lakes. L. Johnson.

88/89-04 Greenland Halibut of the Inshore Eastern Arctic. R. Crawford and L. Dahlke.

88/89-05 Status of the Narwhal, Monodon monoceros, in Canada. J.T. Strong.

88/89-06 Status of the Western Hudson Bay Beluga (Delphinapterus leucas) Populations. P.R. Richard.

88/89-07 Iceland Scallops in the Eastern Arctic. R. Crawford.

88/89-08 Stock Status Sheet Southeast Baffin Beluga (Delphinapterus leucas). R. Stewart.

88/89-09 Quota Recommendations for Commercial Fisheries of Anadromous Arctic Charr, Northwest Territories, 1989/90. A.H. Kristofferson, G. Low, D. Pike and B. Stewart.

88/89-10 Stock Status Report of Arctic Charr Commercial Fisheries of Cambridge Bay, Northwest Territories. A.H. Kristofferson, D. McGowan, G. Carder and G. Low.

88/89-11 Stock Status Report on Canadian Eastern Arctic Bowhead Whales. E.D. Mitchell.